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LOGIC, PRAGMATICS AND GRAMMAR

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EDITOR'S PREFACE

The present volume is the final report from the research project 'Grammatik på logisk grund'(Logically based grammar) at the Department of Linguistics of the University of Göteborg, which was supported by the Swedish Humanistic Research Council during the period 1972-1975. Preliminary reports have earlier been published in a working paper series called 'Logical Grammar Reports' (the papers in this series are listed on p. 9). Research assistants at the project were Jens Allwood, Jerker Järborg and Roger Källström. The project was led by myself. Other people who took part in the project work were Lars-Gunnar Andersson, Michael Grabski and Fred Karlsson.

The aim of the project, as stated in the original application for financial support, was to 'investigate the possibilities of describing central grammatical phenomena in natural languages by logical methods of analysis and models of description'. These logical methods and models were said to be 'those developed within model-theoretical semantics or logical semantics in order to formalize truth-conditions for sentences and conditions for the use of linguistic expressions in general'. Due to various factors, such as the personal interest of the project members and the subsequent development of their views on language, this final volume contains relatively little model-theoretical or truth-conditional semantics applied to natural language.

A large part of the work within the project has been devoted to the application of a grammatical model referred to as 'operational grammar'. The term 'operational grammar' has been used in slightly different senses. In my paper 'Operational grammars' (p. 71-116), it refers to the general format of 'grammars' used in giving formation and interpretation rules for formalized languages. In this sense, although some of the points made in the paper hopefully are, the idea of an operational grammar is far from new. In the other papers in this volume, 'operational grammar' refers to the particular kind of grammar we have developed in the project work for describing our own native language, Swedish. In certain respects, our present model (insofar as one can call it a model) deviates from the original formulations in 'Operational grammars'. We hope the changes in terminology are not confusing to the reader. For some time, we used the term 'logical grammar' in roughly the same sense as 'operational grammar'. This term (and also the fact that the project was referred to as the 'Logical Grammar Project') seems to have led some people to think that we were engaged in 'logical syntax' although it is not clear what they understood by this (probably something like Carnap's 'Logische Syntax'). It may be that we stressed the 'logical' aspects of our undertaking to such an extent that the fact that we were concerned with describing natural language was obscured.

Several working papers have presented different versions of our Swedish grammars. This volume contains two papers devoted mainly to syntax, my 'Swedish Operational Syntax' (p. 117-146) and Järborg's 'Concrete Spelling-out Rules in Operational Syntax Syntax (p. 201-266). There is also a paper on a problem which is at the borderline between syntax and morphology, namely agreement (Källström's 'Agreement Rules for Swedish Noun Phrases', p. 269-274).

We want to emphasize here that 'operational grammar' should not be regarded as an attempt to establish a new 'paradigm' in Kuhn's sense. Rather, we think that the value of work such as ours lies in testing alternative formats of description: almost inevitably, the result will be that the model tested is found to be inadequate, but hopefully, at least some features of it may be found useful. Even if this is not the case, the number of untried roads that may turn out to be blind alleys has been reduced by one. If these remarks seem to indicate undue or insincere modesty on our part, we also want to point out that quite a few features of our proposals are well in agreement with what seems to be general trends in the present development of grammatical theory, as represented by the work of linguists in many different countries, such as J. Anward, P. Linell and S. Öhman in Sweden, R.A. Hudson in England, R. Bartsch and T. Vennemann in Germany, the adherents of 'relational grammar' and even Chomsky and his collaborators in the U.S. and elsewhere.

Another major area of interest for the members of the project has been the study of the relations between pragmatics and/or speech act theory and (formal) semantics of natural languages. This line of research is represented by three papers: Allwood's 'Negation and the Strength of Presupposition' and 'A Critical Look at Speech Act Theory', and my 'Games and Models'. It is now five years since Allwood's first paper was written. One reason for publishing it here is that it is an early example of a point of view which has subsequently been propagated by various other authors. His second paper is a critique of speech act theorists such as Austin, Searle and Grice. 'Games and Models' discusses the application of Wittgenstein's concept of 'language game' to the semantics of natural language.

In addition to the authors of the papers, several persons have been involved in the preparation of this volume. Their help is hereby gratefully acknowledged. Thus, Sally Boyd revised our English and Pierre Javanaud and Iris Niklasson typed the papers.

Göteborg, August 1977,

Östen Dahl.

LIST OF PAPERS IN THE SERIES "LOGICAL GRAMMAR REPORTS"

(1) Östen Dahl: 'On Points of Reference' (Nov., 1972) (also in Semantikós 1.45-61, 1975)

(2) Jens Allwood: 'Negation and the Strength of Presuppositions or There is more to Speaking than Words' (Dec., 1972) (also in this volume)

(3) Lars-Gunnar Andersson: 'Presuppositional Structures in Temporal Clauses' (Jan., 1973)

(4) Östen Dahl: 'Some Suggestions for a Logic of Aspects' (Jan., 1973) (also in G. Jacobsson, ed.: Göteborg Contributions to the Seventh International Congress of Slavists in Warsaw, August 21-27, 1973, Slavica Gothoburgensia 6, Acta Universitatis Gothoburgensis, 1974)

(5) Östen Dahl: 'On the Semantics of Quantified Noun Phrases and Related Problems' (Febr., 1973)

(6) Östen Dahl: 'On Generics' (April, 1973) (also in E. Keenan, ed.: Formal Semantics of Natural Language, Cambridge Univ. Press, Cambridge, 1975)

(7) Jerker Järborg: 'On the Categories of Change in Natural Language' (Sept., 1973)

(8) Östen Dahl: 'Operational Grammars' (Jan., 1974) (also in this volume)

(9) Lars-Gunnar Andersson: 'Questions and other Open Structures' (Jan., 1974)

(10) Jerker Järborg: 'On Interpreting Propositional Attitudes' (Jan., 1974)

(11) Jens Allwood: 'Intensity, Pitch, Duration, and Focus' (February, 1974)

(12) Östen Dahl: 'How to Open a Sentence: Abstraction in Natural Language' (June, 1974)

(13) Östen Dahl - Jerker Järborg - Roger Källström: 'A Fragmentary Operational Grammar for Swedish' (Sept., 1974)

(14) Michael Grabski: 'Sprechakte als Aspekte des Kontexts' (Oct., 1974)

(15) Östen Dahl: 'Individuals, Subindividuals, and Manifestations' (Jan., 1975) (also in S. Kanger, ed.: Proceedings of the Scandinavian Seminar on the Philosophy of Language, Dept. of Philosophy, University of Uppsala, 1975)

(16) Jerker Järborg: 'Infinitive Constructions in an Operational Grammar' (March, 1975)

(17) Östen Dahl - Fred Karlsson: 'Verbal Aspects and Object Marking: A Comparison between Finnish and Russian' (April, 1975) (also in International Review of Slavic Linguistics 1:1-30)

(18) Roger Källström: 'Agreement Rules for Swedish Noun Phrases' (June, 1975) (also in this volume)

(19) Östen Dahl - Jerker Järborg: 'Higher-level Syntax in Operational Grammar' (June, 1975)

(20) Jerker Järborg: 'Concrete Spelling-out Rules in Operational Grammar' (May, 1976) (also in this volume)

(21) Östen Dahl: 'How do Noun Phrases Refer?' (June, 1976) (also in Proceedings from the Third International Conference of Nordic and General Linguistics, to appear)

(22) Jens Allwood: 'A Montague Grammar for a Fragment of Swedish' (also in Proceedings from the Third International Conference of Nordic and General Linguistics, to appear)

Nos. 1-9 are out of print. The remaining papers can be ordered from

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NEGATION AND THE STRENGTH OF PRESUPPOSITIONS

OR THERE IS MORE TO SPEAKING THAN WORDS

JENS ALLWOOD

1 The purpose of this paper is to try to explore parts of the interplay between some of the semantic factors that determine the actual meaning of utterances, i.e. the interpretation assigned to an utterance by a particular speaker or listener. This interpretation does not necessarily have to be identical with the conventional meaning of the utterance.

In particular, I wish to consider the notion of presupposition which has been much discussed in recent literature.[1] But so far this notion has been described rather than explained.

It is my contention that the time has come to consider how presuppositions fit into communication in general and to see if such considerations can help us to explain why there are presuppositions. This is the first task to which this paper is directed. The second task is to give an account of how the actual meaning of negative statements is determined. This is done in view of the importance of the notion of negation for attempted definitions of presupposition.[2] In connection with this, I would also like to make some comments on the logical consequences of presuppositional failure.

2. To start off with, I will give a general account of the factors which I believe contribute to giving an utterance its actual meaning as distinct from its literal conventional meaning. Consider (1).

(1) The bull will be here tomorrow.

(1) could, in an appropriate situation, be taken as a threat, a warning, a promise, a guess or as a simple statement of a future fact. The appropriate force of (1) would be part of its actual meaning, but not of its literal meaning. Literally, (1) is only a prediction about a certain bull's location at a certain time. In fact, it is reasonable to view actual meaning as a function of literal meaning in combination with certain other factors among which we find features of the speech situation (for example, features as those that determine the actual meaning of deictic expressions), explicit rules for certain institutionalized speech acts[3], shared background knowledge and finally certain general rational and ethical norms that hold for all human communicative interaction. It should perhaps be added that in making the distinction between literal and actual meaning, it is by no means denied that a speaker sometimes actually means what he literally says. What is claimed is that this is not always the case and further that, where he does not, this is very often a regular and quite predictable phenomenon. (For a somewhat different view, see Searle 1969).

3 In this paper, I want to consider a part of the interaction between speaker's and listener's meaning and literal conventional meaning. My first task will be to try to explicitly state the most important of the general norms of communication. The norms will be stated so as to delineate an ideal communication situation with maximally effective exchange of information. This situation is of course only approximated in ordinary speech situations, but this need not concern us since what we propose to do is build a model of the ideal communicative competence of speaker and listener. Whether the norms stated are actual conventions for (speech) communication or just tendencies that every rational (speech) communicator would tend to approximate is not critical. The main point is that people actually do try to communicate in accordance with these norms. The norms may seem very much like platitudes; this, however, I think is no sign of danger, it only shows how pervasive they are. On the contrary, if they were not like platitudes, there would perhaps be reason to worry. It goes without saying that a more complete theory of communication will need several auxiliary hypotheses to explain why people do not communicate in the ideal way. In describing the norms for ideal communication, I initially exclude such types of communication as telling jokes, telling stories, being sarcastic and lying. These types of communication I will regard as partly explainable as breaches of patterns of normal communication. They should therefore not be taken as paradigms of what normal communication is.

A basic assumption behind the norms is that communication always involves a joint effort. The speaker tries to communicate in such a way that the listener will be able to understand him and the listener, in trying to understand, assumes that this is the speaker's purpose. Thus, communication always involves a certain amount of cognitive cooperation. Besides such mutual cognitive consideration, there is also usually a number of ethical expectations that come into play between speaker and listener. Communication will therefore often involve ethical as well as cognitive consideration. The following principles are an attempt to capture some of the general norms that seem to underlie most human communication. The norms apply both to speaker and to listener. The speaker tries to act in accordance with them and the listener assumes that the speaker acts in accordance with these norms.

3.1 The principle of agenthood

'A person's behavior is normally voluntary and governed by intention and purpose'.

The purpose commonly associated with communicative behavior is to convey new information. This means that a person's communicative behavior normally is supposed to convey new information and to avoid already shared information.

3.2 The principle of naturalness

'A person's behavior is normally dependent on external causal connections and certain internal psychological and physiological states'.

In communication, such external and internal connections are regularly assumed by both speaker and listener. For example, emotions like anger need not be explicitly expressed since both speaker and listener know that a certain tone of voice normally is connected with anger. Anger can therefore quite adequately be implicitly expressed through that tone of voice. Cognitive attitudes also correspond to external behavior in this way: a statement is an expression of belief, a question expresses curiosity or wonder and an imperative a desire.

3.3 The principle of rationality

'A person's behavior is normally adequate and competent'.

By adequate behavior, I mean behavior that achieves the purpose for which it is intended as efficiently as possible. For communication, this means that the information sent and the way in which it is sent should be as relevant and adequate as possible. Superfluous or insufficient information should be avoided.

By competent behavior, I mean behavior that is undertaken only when its purpose has a chance of being achieved. For communication this means, for example, that a question should not be asked unless it has a chance of being answered or that a statement should not be made unless there is some evidence that it is true.

I believe these three principles in conjunction with an ethical principle like the 'Golden Rule' and a number of specific conventions for various types of communication can contribute substantially to our understanding and ability to explain communicative interaction. For further discussion, see Allwood 1976.

4 I now want to consider how the principles outlined in the preceding question can be used to throw light on some aspects of the analysis of statements.

A statement usually consists of a number of referring expressions indicating referents of which some property or relation is predicated. The predicate is ordinarily a complex, not necessarily continuous expression. This characterization of a statement is of course insufficient but will suffice for the points I wish to make.

Reference and predication can be viewed as two basic communicative acts that together constitute a statement. An act of reference can occur on its own, as in pointing, but an act of predication cannot. Predication presupposes reference. There has to be something of which to predicate.

Further, a predication can be asserted in isolation as in (2) below, or embedded in a larger assertion, as in (3).

(2) The beer is cool.
(3) The beer is cool and the night is hot.

Only if the predication is directly asserted (not embedded) are the general principles fully operative.

Much of what is involved in successful reference and predication can be made clear by studying the conditions which the principles require should be met in order for a statement to be made.

A successful predication can be said to establish a bond at a certain time and place between something which is predicated and something which the predication is made of. Very often the term 'comment' is used for what is predicated and the term 'topic' for that of which we predicate. If there is to be a purpose in asserting a particular predication at a certain time t and place p, we have to presuppose certain things about the topic and comment involved. I will only deal with certain types of predication, namely those that involve a topic which consists of a definite, indefinite or quantified referring expression. What then is presupposed by successful predications of the these types?

Since a predication always involves reference, we can first say that the predication presupposes successful reference. The next question we have to deal with therefore is, what is involved in successful reference?

First and foremost, there must be something to refer to. The intended referent(s) must exist in the universe of discourse that my predication is tied to. (This universe can, if nothing to the contrary is said, be taken to be identical with our own real world (whatever that is)).

I think this requirement must be met, whether we have a definite, indefinite or quantified referring expression in the singular or plural. However, there are some significant differences between the definite and indefinite or quantified expressions. In the case of the indefinite or quantified expressions, we only presuppose the existence of a non-empty domain corresponding to the predicate involved in the referring expression. The quantifier then picks out some number of arbitrary individuals (all or none included) from this domain for predication.

For definite referring expressions, a stronger presupposition holds: here, we do not only presuppose the existence of an arbitrary individual in the domain, but we presuppose that the speaker has in mind some specific individual or group of individuals in the domain, which, if need be, he could identify. In this sense, the individual or group of individuals picked out by the definite referring expression is unique. (Whether something similar also holds for indefinite and quantified referring expressions when they are taken in the sense of a (certain) boy was here yesterday need not detain us here).

These conditions can be related to the principles of agenthood and rationality. The purpose of referring would be lost if there was nothing to refer to. The principle of rationality requires a competent person only to perform actions he believes can succeed. Before a speaker refers, he should therefore have evidence that the purported referent exists. In the case of definite referring expressions, we further have the right to take for granted that the speaker knows exactly whom he is speaking of, that there is a definite unique individual or group of individuals to whom he is referring.[5]

This requirement on definite referring expressions has the effect of making it possible for us to assign a definite truth-value to each statement token containing a definite referring expression. For what we in fact are requiring is that the speaker be able to supply the space-time coordinates for this referent, thereby making it possible to assign the statement about the referent a truth-value. The fact that we take it for granted that statements can be assigned truth-values of course greatly increases their informative value and thereby also the point of making statements.

These facts can perhaps be expressed in the following way: Referring expressions presuppose the existence of their intended referents. Definite referring expressions further presuppose the identifiability and uniqueness of their intended referents.

After having studied how successful predication also involves successful reference, we now turn to the predicate side of the predication.

In order to predicate successfully, it must be possible at the time and place in question for the referents to possess the property which is predicated of them. 'Possible' can here be taken in a logical or in an empirical sense, depending on the view one has of the relation that holds between a property and the bearer of the property.

This condition on successful predication can also be related to the principle of rationality. We can alternatively express it as follows: Predication presupposes categorical compatibility between predicate and referent.

What is meant by this is something like the following:
The predication presupposes that the individual(s) picked out by the referring expression of the topic is a member of the domain corresponding to the predicate of the comment. (By domain, we simply mean those individuals which could possibly, but which do not necessarily factually have the property corresponding to the predicate). So, what a predication does is to claim that a possible argument of its predicate at time t and place p is also an actual argument at the same place and time.

I shall refer to the conditions discussed with regard to reference as the *existential, uniqueness and identifiability presuppositions of reference* and I shall refer to the condition discussed with regard to predication as the *categorial presupposition of predication*. Consider the following example:

(4) My car is green

The referential presuppositions of (4) implicate that there exists a unique and specific car which is mine and the predication categorially presupposes that cars can be green.

By the competence requirement of the rationality principle, the listener is entitled to think that the presuppositions for reference and predication are filled. Often he will himself possess sufficient knowledge to know that they are, but this is not necessary. Whether he knows or not, he will have a right to suppose they are.

But the principle of agenthood still remains to be dealt with. If what is presupposed is common knowledge, then this is not usually communicated by a statement. This is not the purpose of the statement. The purpose of a statement instead is to communicate something within the background framework created by the presuppositions. I usually don't refer just to refer, but to predicate.

However, there are, as has been noted above, cases of more or less pure reference. Pointing is the paradigm of such cases. Cases of naming, existential and demonstrative statements are also closely related to pure reference. But the fact that existence, identifiability and uniqueness are directly asserted rather than being presupposed in these statements creates an important difference between these statements and the statements in which we refer in order to predicate.

This account of the presuppositions of referring expressions is lacking in at least one important respect. It should include some mention of the expressions that qualify a referring expression. Two common examples of such qualifying expressions are adjectives and restrictive relative clauses. The big boy, The boy who is big. The information given in such qualifying expressions is also presupposed in the sense that it is not part of what is directly asserted: The boy who is big has long hair. The difference between this type of presupposition and the ones previously discussed is that in the latter cases, we were discussing presuppositions of all referring expressions, while here we are discussing the presuppositions of certain particular definite referring expressions . If existence and uniqueness which are general presuppositions of all definite referring expressions are added to a definite referring expression , as qualifying expressions, we either get the uneasy feeling associated with *redundancy* or else we get the feeling the speaker is not sure whether the presuppositions really are satisfied, e.g. that the referent perhaps does not exist or is not uniquely identifiable. Consider: The one and only queen of England who exists lives in Buckingham Palace.

In the same way, we don't usually predicate just to indicate categorial compatibility, but to indicate that a certain referent or group of referents have a definite property.

Just as with reference, there are ways of explicitly indicating categorial compatibility linguistically. Examples are generic statements and different types of modal statements. However, again we must remember that in these statements, categorial compatibility is directly asserted rather than presupposed rather than presupposed. Consider some examples of negative and affirmative assertion of categorial compatibility.

(5) Cars have color.
(6) Electrons do not have color.
(7) Cars can be green.
(8) Electrons can't be green.

Let us recapitulate – by the competence requirement of the rationality principle, we assume the reference and predication involved in a statement to be correct and therefore also the corresponding presuppositions to be true. As these presuppositions mostly are common knowledge, they cannot be the point of the statement, rather they are the background against which the actual statement is made.

This analysis I think captures some of the basic features of statements and shows some of their connections with other communicative phenomena.

5 The special types of statements that I want to deal with in this paper are negated statements or simply negations. Negations share most features with ordinary statements, that is the postulates and the presuppositions that have to do with reference and predication are true of them too.

But I think that in addition we have to acknowledge at least one further specific constraint for negative statements. It can be stated as follows: A negative statement is appropriate when its affirmative complementary is in some way expected. This is especially true when the negation is of the type it is not the case that or it is not true that, but it also holds true for most cases of not. Standardized phrases of the type not bad are exceptions.

The constraint is related to the principle of agenthood. In order for a negative statement to be of reasonable interest and newsvalue for the listener, it must be non-obvious. A good way for it to be non-obvious is for it to deny an in some way expected affirmative statement. The constraint is therefore completely parallel to the corresponding general condition for affirmative statements. Let us study some examples:

(9) The barber did not have lunch today.
(10) The captain is not drunk today.

I think it obvious that these statements are pointless even if trivially true if the said gentlemen never eat lunch or drink.

An interesting thing to note is that this constraint, which I will call the expectedness constraint on negations, is not restricted to negative statements but seems to carry over to negative questions and requests as well. Compare the following sentences:

(11) Bill smokes.
(12) Bill doesn't smoke.
(13) Does Bill smoke?
(14) Doesn't Bill smoke?
(15) Smoke, Bill!
(16) Don't smoke, Bill!

It seems clear that (12), (14) and (16) are all alike in that they in some way signify expectance of the affirmative complementary statement. (12) is a straightforward denial of a purported fact. (14) in contrast to (13) could be an expression of surprise at the expected not being true. (13) has a more straightforward relation to (11), asking if (11) signifies a fact or not. (16) is a countercommand to a purported action and therefore has an immediate relation to (15) and a more indirect relation to (11).

It is always bad to speculate about phrases of politeness because of their idiomatic character, but I would still like to suggest that the difference we perceive between (17) and (18), (19) and (20) below (if we perceive any) is largely due to the purpose requirement of the principle of agenthood, with its expectedness constraint on negations:

(17) Could you pass the salt?
(18) Couldn't you pass the salt?
(19) Would you like to go to the movies?
(20) Wouldn't you like to go to the movies?

The fact that (17) and (18) are literally questions but here function as requests can be given a relatively satisfactory analysis through the principles of agenthood and rationality. (See Searle 1975).

The expectedness constraint for negation can also be used to explicate a notion of foolish questions and superfluous orders. Imagine (21) below asked about a man who never drinks and (22) as an order to a man who is just about to open the door anyway.

(21) Is the captain sober today?
(22) Open the door!

Part of what the purpose requirement of the principle of agenthood implicates for requests and questions is that what is requested or questioned must not be completely obvious and expected, which of course is also part of what it implicates for statements. Let us consider some more examples:

(23) There was no grass growing on that lady's head.
(24) That man has no fins.

These sentences are queer not only because they violate the expectedness constraint but also because they are on the verge of breaking the competence requirement of the rationality principle. In particular, they come close to breaking the categorial presuppositions that have to be satisfied for successful predication. It is highly doubtful whether a man can have fins at all and still remains a man or a lady can have grass growing on her head and still remain a lady.

6 In the discussion of affirmative statements with definite referring expressions as topic, we claimed that such statements consist of two parts, one with a referring function and one with a predicating function. The competence requirement implicates that to successfully perform these functions, two presuppositions must be filled: what is referred to must exist and be uniquely determinable and what is predicated must be categorially compatible with what is referred to.

These conditions related to the competence requirement hold for all statements including negative statements, so long as they are not existential or categorial. The point of stating is not to assert the presuppositions of the statement, these we take to be true anyway via the competence requirement. Concerning negative statements, one could put this another way by saying that the negation usually denies what its affirmative complementary states rather than its possibility of stating this.

We now see still more clearly why the inappropriateness and trivial truth of (23) and (24) is slightly more upsetting than the inappropriateness of (21) and (22). In all four cases, we would be violating the purpose requirement, but in addition the competence requirement might be violated in (23) and (24).

Usually, however, the principles of normal communication are so strong that we are not willing even to recognize that they might be violated. Consider (25) and (26).

(25) Electrons don't have color.
(26) The electrons are not green today.

Obviously, if (25) is true, (26) must be so also. But notice the outrageousness of someone using (26) to convey (25). It's outrageous because if (26) appeared out of the present deductive context, we would naturally take the requirements of competence, adequacy and purpose to be met. What would be the purpose otherwise of asserting (26) when generic and categorial statements are also available in the language? We see here how the adequacy requirement of the principle of rationality in combination with the other requirements effectively excludes certain interpretations. Why say x which implicates a and b - which are not true - to say y if you can use z - which does not implicate a or b - to say the same thing? The adequacy requirement usually prevents the above from happening.

It might be worthwhile to remark in passing as this is not the main topic of the present paper that the principles implicate very similar things for statements, questions and imperatives. We can here explicate a notion of misleading questions and impossible orders parallel to the above given notions of foolish questions and superfluous orders. Consider (27) and (28).

(27) Is the number five red?
(28) Bill, would you please be exactly 52 years old!

The competence requirement implicates that questioning whether a certain predicate holds of a certain referent implicates that it is possible for that predicate to hold of the said referent. For requests, it implicates that it is possible for the addressee to perform the action requested. These implications are obviously not fulfilled in (27) and (28), therefore they are misleading and impossible respectively. In addition, the adequacy requirement says that this is not a permissible way of asking whether numbers have color or for requesting Bill to undergo plastic surgery.

Sometimes, the purpose requirement makes utterances of the type discussed here acquire a type of meta or second-order point. (28) could perhaps function this way. But there are clearer cases.

(29) Roses are not elephants.

The competence requirement is so obviously violated in (29) that the purpose requirement makes it clear that what is intended in (29) is not to assert something about elephants and roses, because this is trivial and besides it violates the competence requirement. Instead, the point of the statement is to assert its own triviality. This trick is often used when one does not directly want to tell somebody that what he is saying is trivial. I believe meta-points of this type are also what is behind some types of irony and sarcasm.

7 Some of the properties we have noted in negative statements seem in an interesting way also to apply to the negations of terms or opposites.

In traditional semantic theory, one usually distinguishes between several different types of opposites. One talks of complementary, antonymous and incompatible terms.[6] Underlying these different types, there is the more general difference between contrary and contradictory terms. I want to discuss this latter distinction in relation to complementary terms.

For a start, let us consider some examples of opposites that are complementary terms:

(30) alive (living) - dead
(31) married - unmarried
(32) male - female

The negative term of the opposition also very often occurs as a straightforward negation of the positive term: not alive, not married, not male.

One way of looking at complementary opposites would be to say that they are terms of a binary property dimension – a dimension that we in the above cases could designate by the terms *life state*, *marital status* and *sex*. This would be a trait that would clearly separate them from other terms such as color terms of a greater than two valued dimension.

Another way of looking at complementaries is to say that we have a single property that is either affirmed or not affirmed of a specific range of referents. One could say that the terms were limited in their application to a restricted universe of discourse. For example, if we speak of students and non-students, by non-students we designate individuals who could have been students, but in fact are not.

We see that what is going on here is something very similar to what we noticed in regard to negated predication, namely that the negative terms seem to be interpreted with categorial presuppositions. Terms opposing each other, with categorial presuppositions intact, within a limited universe of discourse are said to be contraries. If the universe of discourse is unlimited and there are no categorial presuppositions, they are said to be contradictories.

It should not surprise us that most complementaries are contraries, not contradictories, because it is reasonable to assume that they are derived from negative statements, where they of course would acquire this restricted sense, due to the general norms of communication. The negative complementary terms so to speak carry over their sense in negative statements to their occurrence as isolated terms.

Even if this second way of looking at the problem of complementary terms gives the best picture of what is going on, the first way suggested to describe the facts also captures an important aspect of the problem. The tendency for negatives to become restricted is very much strengthened if there is a possibility to view the complementary terms as two positively distinct values of a single property dimension. In fact, I think that this is a necessary requirement for the appearance of special terms to replace the negative complementaries; it might also be a requirement for negative affixation (e.g. unmarried).

Negative complementary terms are used restrictively both when they have a predicative function and when they have a referential function.

(33) They are unmarried (not married).
(34) The unmarried are to be envied (those who are not married).

The categorial presuppositions of married prevent both (33) and (34) from being used to say something about stones. This is so both in (33) where unmarried has a direct predicative function and in (34) where it functions predicatively within a definite description with referential function. However, it seems to me that it would be more odd to use (34) than (33) to say something about stones.

The reason for this I think has to do with what the competence requirement implicates for reference. We must refer to some specific referent or group of referents. This requirement can only be met if the categorial presupposition of unmarried is taken to be valid. The negative term without any categorial presuppositions would not refer to any group of referents in particular, but to all referents that are not included in the extension of married. There is also some evidence that presuppositions are stronger when they are connected with the topic rather than the comment of a sentence. (See below p.39).

We have previously observed that categorial presuppositions are usually not valid in negative generic sentences; we would therefore expect this to be true also when negative complementaries are used in such sentences.

(35) Stones are not alive (animate)
(36) Stones are dead

While (35) is fully acceptable, (36) is perhaps somewhat queer[7], but to my mind still acceptable. In generic statements I think it is very common for people to use dead in this negative unrestricted sense. However, when there are positive characteristics connected with both of the complementary terms, such a substitution is not possible.

(37) Stones are not male.
(38) Stones are female.

While (37) is barely acceptable as a true sentence, (38) is both unacceptable and false. An additional difficulty here which is creating low acceptability is the implicatory relations that hold both between positive and negative predicates, i.e. not alive → not male, and male → alive. This makes it redundant to speak of stones as not male.

8 I am aware that much remains to be said about opposites, but hope at least to have shown that considerations of general speech restrictions is relevant to their semantic functions.

We will now return to the issue raised earlier of meta or second-order points. This issue brings up the interesting question of whether there are circumstances in which one can obviously violate the restrictions imposed by the principles of communication and still manage to convey reasonably clear information. I think this is so and hope to demonstrate some such instances. Furthermore, I think that the fact that this is so (if indeed it is a fact) can be explained by reference to the basic assumption of joint effort (see above) and a second-order application of the postulates themselves.

As my particular interest in this paper is negation, the examples I want to consider are all cases of negation. But in order to do this, I first want to make some further general remarks about negation. We have already seen what the principles of communication implicate about the function of negation in statements. What I now want to consider are some remarks on the logical force of negation and some facts of common usage about negation.

There are very many expressions in natural language that can be used to deny or negate a statement. Among these are the following which I think are more or less synonymous: not, it is not the case that, that's false, that's not so, that's not true, that's wrong and that's not correct.

The first point to note is that all these expressions could just as well be said to be expressions of negation as of falsehood. They could be used with equal right to negate or to falsify a statement. This, of course, is no accident: by negating a statement, one says that the statement is false and by claiming a statement to be false, one says that the state of affairs described by the statement is not a fact. There might be some idiosyncratic occurrence restrictions on the different expressions, but I think it is pretty clear that they all express the same basic notion.

This basic semantic function which I take to be the logical force of negation can be characterized as follows: To negate a statement is to say that the state of affairs described by the statement is not a fact. To assert a predication is to claim that the state of affairs it describes is a fact, while to assertively negate the same predication is to claim it is not.

Negative statements are subject to the restrictions that hold in general for all statements. Therefore we have seen that a negative statement does not usually just claim that what is stated is not a fact. It disqualifies the purported factual status in a specific way, a way that is consistent with what the postulates of communication require of statements as to the fulfilment of categorial and referential presuppositions. So the actual meaning of a negative statement is produced by the logical force of negation subject to restrictions imposed by general norms of communication.

Having made clear how the actual meaning of a negative statement is a function of at least the logical force of negation and general constraints on statements, we are now in a position to discuss the problem posed earlier. What happens to the actual meaning of negative statements when the general restrictions governing statements are violated? Do they become nonsensical or, as in the example above (see (29) p.27),can some new and different actual meaning be conveyed through the interaction and extension of the general norms. I think the latter can be the case and will attempt to show that this is the case, by systematically trying to pair a violation of presuppositional restrictions with a compensatory context.

Let's start off by reconsidering sentence (26) which, as we remember, violated a categorial presupposition. Consider the following compensatory context for (26).

Smith is starting to teach his class sub-molecular physics and carefully explains that electrons do not have sensory qualities such as color. The following lesson is spent in the physics lab working with electron microscopes. Suddenly Sam, who had been asleep the previous lesson, shouts: 'I see an electron - a little green one!'. To this Smith indignantly replies: 'I had expected you to know at least one thing today and that is that - if that is an electron, it is not green'.

Although what Smith wants to express with the last remark normally would involve a breach of presupposition, it does not do so here. The explanation I think is something in the following vein.

If it is true that electrons don't have color, it is of course trivially true that they are not green. So the negated predication without any assertive force is true. Normally, it would be inappropriate if uttered as a negative statement because of the categorial presuppositions implicated by the competence requirement. But in this case, the context has cancelled the normal categorial presuppositions by explicitly invalidating the implicatures of the competence requirement. In fact, this invalidated implicature is part of the point of the utterance. The teacher wants the student to realize the triviality involved in the truth of his statement. Finally, it is worthwhile adding that with the situational background we have constructed, the normal categorial presuppositions of questions could also be cancelled. Consider the following dialogue a couple of lessons after the lesson we have just discussed.

(39) Now Sam, are electrons green?
(40) No, electrons don't have color.

Normally, an answer of this type negating the presuppositions of the question would be inappropriate, but here it is OK, because the presuppositions are precisely what is at issue.

Next, let us try to construct a similar cancelling of the referential presuppositions of a statement.

Jones, who has a bad case of paranoia, repeatedly assures his doctor that the czar of Russia is waiting on the lawn to kill him. The doctor says, to calm him: 'No, that's not true, the czar of Russia is not on the lawn. You know very well that there is no czar of Russia'.

Here again, we notice that a statement which normally would be very misleading because of discourse implicature, can be used appropriately when that implicature is explicitly invalidated.

When the implicature is invalid, the presupposition is cancelled and it becomes possible to express the normally trivial truth that non-existent entities have no properties. Again, the very obviousness of this truth is the point of the statement. So when it is common knowledge that what is normally taken for granted no longer can be taken for granted, a negative statement acquires the new point of pointing this out to those who are not aware of it. Because of the comparative nature of speech communication, the purpose requirement so to speak forces a point out of the seemingly pointless.

Again, there is a parallel in questions. When Jones has almost recovered, the doctor asks him:

(41) Is the czar of Russia still waiting to kill you?
(42) No, he doesn't exist, doctor.

To sum up, we can say that the presuppositions of negative statements can be cancelled if the normal implicatures of the relevant postulates of communication are commonly acknowledged to be explicitly invalidated.

9 The cases we have studied so far have all depended on extra-linguistic context to be accepted. The next question will be whether there are any ways of linguistically marking that implicatures are changed or cancelled. We have already noted negative existential, generic and modal statements. Statements containing never, no more, not any more and no longer are ambiguous in an interesting way.

(43) The Georgian seminarist is not the dictator of Russia any more.
(44) Smith will never write any novels.
(45) Hitler will not scream again.

I think all of the above statements can be taken in two senses, one with referential presuppositions intact and one where they are altered or cancelled.

(43a) He lives the quiet life of an old age pensioner.
b He is dead.
(44a) The promising young genius was killed.
b He is so untalented that it would be impossible.
(45a) He has caught chronic laryngitis.
b He is dead.

Never, not any more and not again are very strong semantically. By the postulates of competence and adequacy, there must be some good reason for using these expressions. The non-existence of the referent would be such a reason.

Here we see how the actual interpretation (meaning) of a statement must be viewed as a function of both literal meaning and general discourse norms. These factors jointly determine whether normal presuppositions hold and when the result is indeterminate we get several different possible interpretations as in the cases above.

There are some interesting examples in Russian where case is used to mark a change in the presuppositional status of a referent. In Russian, the direct object of negated statements can either be in the accusative or in the genitive, but there is a tendency to semantically differentiate the two.

(46) Ja ne čital knigi (accusative)
(47) Ja ne čital knig (genitive)

(46) usually means I have't read the books (certain particular books) and (47) usually means I have not read any books at all. What is at stake here is primarily a change of the referential uniqueness presupposition. The distinction in Russian is evidently related to the difference in English between the definite and indefinite article. Compare:

(48) I have not seen the book for a year.
(49) I have not seen a book for a year.

But I will not speculate here on the precise nature of this similarity.[8]

10 Another phenomenon that affects the meaning of a negative statement is contrastive stress. It is probable that its effects are the same in negative and positive complementary statements, so that the negative statement is the negation of an affirmative statement with contrastive stress applied.[9]

Let us therefore first study how stress affects the presuppositions of a positive statement. (The stressed word is underlined).

(50) Bill broke the window.
(51) Bill broke the window.
(52) Bill broke the window.
(53) Bill broke the window.

The contrastive stress has the effect of changing what is asserted in the statement. In (54) the whole VP is asserted of Bill. In (51) we know or presuppose that Bill did something to the window, what is asserted is that he broke it. Finally, in (53) we presuppose that someone broke the window; what is asserted is that it was Bill.

We see that what is asserted and what is presupposed changes simultaneously. So although contrastive stress only directly affects what is asserted, it indirectly also affects what is presupposed. (50-53) have different presuppositions in each of them; what is not directly asserted is presupposed. If this is correct, it should be verified by checking the presuppositions of the negative complementaries of (50-53).

(50') Bill did not break the window, he was in France.
(51') Bill did not break the window, he broke the door.
(52') Bill did not break the window, he smashed it.
(53') Bill did not break the window, John did.

If we now compare (50-53) with (50'-53'), I think it is clear that complementary sentences have the same presuppositions. This verifies the claim that contrastive stress changes presupposition and also makes clear that its effects are the same in positive and negative sentences.

Stress often has the effect of making what is asserted more specific, thereby increasing the amount of material in the sentence that is presupposed. This of course restricts the applicability of the stressed sentences to a more narrow range of circumstances than the unstressed ones. So for example (50) can be used about Bill any time he breaks a window, but (51) would only be applicable when we already know things have been broken and that Bill is responsible for one of the breakings. Similarly, this is also true of (52-53). We see that in every case the stress raises the presuppositional requirements on appropriate situations.

The connection between what is asserted and contrastive stress I think ultimately can be derived from the requirements of purpose and adequacy (no superfluous or insufficient use of language). A perfectly good and sufficient reason to highlight a part of an assertion is of course that we want to restrict the assertion to the highlighted part.

The way negation is affected in (50'-53') also shows the very strong tie between what is directly asserted and what is negated. In other words, the 'scope' of the negation changes in (50'-53') because negation is normally tied to direct assertion.

It is instructive to observe that the same phenomenon appears in existential statements,

(54a) It's snowing.
b It's snowing.
c It's not snowing. (The sun is shining).
d It's not snowing. (It's raining).

In (54b), we presuppose some unusual meteorological state and what we are asserting is its precise nature. In (54c) and (d), we first have to deal with the expectedness constraint that holds for negative statements in general. But keeping this in mind, I still think there is a subtle difference between (c) and (d), which follows from the difference between (a) and (b). The difference comes out clearly if we add the qualifying clauses to (c) and (d).

It's raining would be appropriate for both (c) and (d) but The sun is shining would not be appropriate as a qualifying statement for (d). In other words, (d) is applicable in a more narrow range of situations than (c), due to the fact that its assertion is more specific and its presuppositions stronger than those of (c). More precisely, one might say that the range of situations in which (d) is applicable is properly included in the range of situations in which (c) is applicable.

11 We have already seen how the topic of a statement is tied to certain referential presuppositions. But how do non-topical referring expressions function in this respect?

A referential expression acting as topic in a sentence almost invariably keeps its referential presupposition in negations, while a referential expression occurring as comment very often is taken to have no such presuppositions.[10]

Speaking about the archbishop, we say:

(55) The archbishop visited Brighton Cathedral.

To which a reply which is entirely in order is:

(56) No, he did not, as there is no cathedral in Brighton.

Or, speaking of Cologne Cathedral we say:

(57) Cologne Cathedral was visited by the archbishop of Scotland.

To which again an entirely adequate reply would be:

(58) That's false - there is no such man.

The negative existential comments are here in no way experienced as strange.

My feeling is that the difference between topic and comment in this respect can be nicely accounted for by viewing the comment as a complex predicate expression in the form of a *one* or *many-place sentential function* with an empty place for the topic.[11]

Anything that invalidated the sentential function would then be equivalent to a falsification of the assertion. This would correspond nicely to our finding above that negation and thereby also falsification are closely tied to what is asserted rather than to whatever the assertion is being made about.

A breach of the referential presuppositions of the topic makes us more uneasy, because the topic provides the base for the assertion (that of which we speak). And in view of the close connection between falsification, negation and the asserted part of a sentence, it is also natural that we are less inclined to call a statement false when its topical presuppositions are broken than when those of its comment are broken.

12 Finally, I want to consider the so-called factive presuppositions of verbs like realize and know.

In order to realize or to know something, what we know or realize must be a fact. This is part of the requirement we put on knowledge. Other requirements are that we must be informed of and that we must have good evidence for that which is to count as knowledge. At least the first requirement distinguishes know and realize from other verbs of propositional attitude such as think, believe, suspect, be sure of and be certain that.

The adequacy and competence requirements of the principle of rationality implicate that when we state of x that he has knowledge of y, it is taken for granted that y is a fact and that the information we want to convey is that x has now knowledge of y.

As in the case of referential and categorial presuppositions, factive presuppositions carry over into negatives, questions and even imperatives.

(59) Bill doesn't know that there are black holes in the universe.
(60) Do you know that 1968 was a leap year?
(61) Come on Bill, will you please realize that two plus two makes four!

In all three sentences, the object for realization or knowledge is taken to be a fact. In (59) and (60), we are concerned whether someone has information of that fact and in (61) (which perhaps is a little odd) we want the evidence at hand to convince Bill.

However, factive presuppositions can also be cancelled by a compensatory context changing the normal implicatures of the postulates of communication. Consider the following context:

Smith has through careful observation and computer work determined that there must be 10 planets in the solar system. Armed with this knowledge, he goes to an astronomical congress where Jones, another astronomer, presents a theory based on our supposed knowledge that there are nine planets. When the presentation is over, Smith stands up and says:

(62) I think Jones' theory is incorrect, because we don't know that there are nine planets. (There are in fact ten)[12]

The point of this utterance could not be to assert that we do not have information or evidence of there being nine planets, we obviously do. There must be some other point then, namely the trivial point that one cannot know what is not a fact. This is of course always true, but normally the principles of communication prevent us from interpreting a negative *know*-sentence this way. Here, the normal implicatures are invalidated so by the purpose requirement, there must be some other point.

Even though other factives are more difficult than *know* when it come to finding compensatory contexts, I think the following sentences could probably be made to pass with a little imagination.

(63) We will never realize what Jesus strove for us to realize, because his whole theory was based on a misunderstanding.

(64) Molly is not $\left\{\begin{array}{l}\text{astonished}\\ \text{surprized}\\ \text{amazed}\end{array}\right\}$ that there are only ten million people on earth. Why should she be, when it is not true?

In fact and *really* are often inserted in *know* sentences to cast doubt on the factive presuppositions.

(65) Chomsky doesn't really know that linguistic competence is biologically determined.

(66) Does Chomsky really know that linguistic competence is biologically determined?

The competence and purpose requirement (our knowledge of Chomsky's position on this question) in combination with the morpheme really in my opinion rather heavily biases the interpretation in favor of one without factive presuppositions.

We have already noted that factive presuppositions can be cancelled by what could be called commentary clauses (cf. (63)and (64)). Here are a few more examples:

(67) Dante didn't of course know that the earth was flat.
He only thought so.

(68) One could say about Newton that he did not (really) know that there was an absolute time and an absolute space, he only had very good reasons for believing it.

The commentary clauses here point out the incorrectness of the usual assumptions about lack of knowledge, leaving the falsity of what is normally presupposed as the only reasonable way for these statements to satisfy the purpose requirement.

13 I now want to draw some conclusions of the discussion so far, pertaining to the logical implications of presuppositional failure. We have seen that the actual meaning or interpretation of a negative statement depends on many factors. In the present discussion, we have prominently featured literal meaning, general norms of communication and extra-linguistic context.

We have in all cases taken negation to be the same basic semantic operation indicating that a certain state of affairs is not a fact. We have taken negation to have exactly the properties of logical negation: always giving the predication it operates on an opposite truth-value. The difference in the actual force of negative statements has been explained by factors such as stress and topicality, as well as the above-mentioned three things.

Let us now deal specifically with the consequences for logic of the preceding discussion. First let us note that one of the most important tasks for logic is to explicate the notion of valid inference. Roughly, a valid inference is an inference that lets us infer in a truthful way what is and what is not the case.

To claim that a statement is false is to claim that the state of affairs described in the statement does not obtain. This and only this I claim is the logically interesting property of falsity. This is the logical force of falsity. How and why the state of affairs fails to obtain is of course very interesting from a communicative point of view but logically it is irrelevant.

The general norms of communication usually preclude certain types of falsehood, e.g. falsehood depending on reference failure or categorial incompatibility. Such norms are rational and facilitate communication, but they have no logical import. A breach of these norms leads to failure and confusion in communication - but should not lead to a similar confusion in logic. Truth and falisty in the logical sense have only to do with WHETHER a certain state of affairs does or does not obtain and not at all WHY it does not obtain.

A statement can be deviant in relation to general norms of communication without therefore losing its truth value as a result. Logical force must be differentiated from communicative force.

'True' and 'false' - the two fundamental concepts of logic - are used only to indicate whether something is the case or not. The inferences of logic are based only on this information, no other information is needed. There is no reason why the logical notions should be subject to the general norms of communication, which tell us not only THAT a statement is false, but also WHY it is false.

Negation has the same basic function as falsity. To negate a certain statement or to say of the same statement that it is false is logically to do the same thing, namely to claim that the state of affairs described in the statement does not obtain.

However negative statements are of course subject to the general norms of communication. In negative statements, we therefore know not only that a certain state of affairs does not obtain, but also why it fails to obtain, in the sense that certain reasons for why a statement could be false are ruled out by the presuppositions of statements in general.

That the norms of communication enable us to extract this extra information from most negative statements should not lead us to believe that this extra information also is constitutive for the logical force of these statements. It is unfortunate that this simple point has not been observed by those who have discovered and made the notion of presupposition into the important concept it is in the semantics of natural language.[13] These people are of course completely right in insisting on a distinction between what is presupposed by a statement and what is stated by it. Russell was here strangely blind to the subtleties of natural language.[14] I think one of the reasons Russell went wrong and that those who have come after him also have gone partly wrong, is that they all hold a far too parsimonious view of what enters into linguistic communication.

Russell thought that one could only assign falsity to a statement if that which was actually explicitly claimed by the statement failed to obtain. He therefore thought that all the ways in which the state of affairs described by a statement could fail to obtain had to correspond to explicit assertions. On these grounds he created a conjunctive set of assertions to guarantee that a state of affairs could not fail to obtain without falsifying its corresponding statement. Thus, for whatever reasons a state of affairs asserted by a statement did not obtain, there would be a corresponding statement which could be explicitly and directly falsified. The doctrine that only what is directly asserted can falsify a statement led Russell to the belief that everything that goes into the making of a statement is in fact asserted.

This doctrine is held also by the followers of Frege and Strawson, who in their denial of Russell's claim that far more than meets the eye is asserted by a statement, have been led to revise the law of the excluded middle either directly by postulating a third truth value[15] or by claiming that the question of truth or falsehood does not arise[16], that there are truth-value gaps[17], that there are different truth and falsity conditions[18] or finally that there are two different types of falsehood and negation (internal and external)[19].

In all of these doctrines (and here I include those propounded by the followers of Frege and Strawson) one of the following two in my opinion correct common sense opinions are denied:

1. Only that which is directly asserted by a statement is in fact asserted (denied by Russell).
2. Every statement is either true or false (denied by Frege-Strawson).

As we have seen, the reason for both types of denial is the (non-common sense?) view that only what is directly and explicitly asserted can be falsified or negated. However, our preceding discussion has shown this to be false for two reasons: First, it is by no means always the case that only what is directly asserted can be falsified or negated. Compare what happens when the direct assertion is cancelled by the context: What is normally presupposed then becomes the point of the statement and can naturally be negated and falsified (cf. pages33 -39)

Secondly, the view in question involves a misunderstanding of the logical role of negation and falsehood. That role is, if we are allowed to repeat, purely factual. The only thing that is claimed logically in negating or falsifying is that the state of affairs described by a statement fails to obtain. Why it fails to obtain is irrelevant for logical inferences (concerning which states of affairs obtain given certain other states of affairs), but is very relevant to the analysis of what is ordinarily communicated by negating a statement or claiming it to be false, because here we have to take the general norms of communication into full account.

To my mind, it is the addiction to Occam's razor with a corresponding unnecessarily frugal view of what goes into linguistic communication that is responsible for the prolonged discussions of the consequences of presuppositional failure. We must learn that there are a multiplicity of factors involved in linguistic communication (this paper has only begun to explore a few) and we must learn to carefully separate these from each other in order not to jump to hasty and unwarranted conclusions. We must learn that there is more to language than words.[20]

I think that in the long run my account for the diversity of actual meaning will be simpler than that of the above-mentioned theories, although it may not look so at present. I think many of the factors I have used in the analysis of negation will be seen to reappear in the analysis of many other linguistic phenomena.[21]

POSTSCRIPT

This is a revised version of a paper written in 1972 and published then in the form of a working paper. I would like to thank Östen Dahl for rewarding discussions of many of the points treated in the paper. I would also like to thank Lars-Gunnar Andersson for reading the paper. Naturally, this does not mean that their views coincide with mine in every respect. In fact, since the article was written five years ago, the views expressed in it no longer coincide even with my own ideas on all points. But rather than revising the article entirely, I have let some of these points remain as they are.

FOOTNOTES

1 See Russell 1969, Strawson 1969, Keenan 1971 and Garner 1971.

2 See Keenan 1971.

3 Cf. Searle 1969, esp. Chapters 1 and 2.

4 What follows heavily draws on work by the following authors: Austin 1962, Furberg 1971, Grice 1975 and Searle 1969.

5 The preceding account owes much to Searle 1969, esp. Chapter 4

6 Cf. Lyons 1969, 458 ff.

7 It is probable that the ordinary categorial presuppositions for dead and not alive in non-generic contexts are stronger than mere compatibility between referent and positive complementary term. Dead seems to presuppose not only that it is possible for the referent to be alive, but also that the referent has in fact been alive.

8 For a more thorough discussion of this, see Dahl 1971.

9 Cf. Chomsky 1971 and Dahl 1969.

10 Cf. Strawson 1971.

11 See Allwood-Andersson-Dahl 1972, 92.

12 Many people find it easier to accept 62 if they stress know but personally I don't find this necessary. However, one would in fact predict that the stressed case would be easy to accept from what has been said about stress above. This holds true also of sentences 63-68.

13 For a good summary, see Garner 1971.

14 Cf. Russell 1969.

15 Cf. Keenan 1972.

16 Cf. Strawson 1969.

17 Cf. Quine 1960.

18 Cf. Keenan 1972 .

19 See White 1970 who comes closest to this position.

20 However, I am not claiming that actual meaning is not amenable to logical analysis. On the contrary, I think it is, especially if one uses a possible world semantics and some form of modal logic. In particular, I think e.g. that the connection between material and strict implication can be nicely accounted for within a framework of communicative postulates. (See Grice 1975).

21 So far, the most interesting work in this direction is presented by Grice 1975.

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A CRITICAL LOOK AT SPEECH ACT THEORY

JENS ALLWOOD

One of the most powerful theoretical conceptions behind current research in pragmatics[1] is the idea that a theory of linguistic communication is really only a special case of a general theory of human action. According to this view, the various linguistic subdisciplines such as phonology, morphology, syntax and semantics should be regarded as the studies of different abstract aspects of underlying communicative actions. Explanation of variation within each subdiscipline should preferably be functional, i.e. it should relate the properties of the phenomenon being examined to the function of a communicative action as a whole. If this task could be accomplished, the functionalist claim is that linguistic theory would simultaneously achieve both increased exhaustiveness and greater internal coherence and simplicity.

A precondition for success in this enterprise is the establishment of a conceptual framework for the description of action, with enough internal structure to make possible an account of the relationship between linguistic phenomena and action with sufficient detail to be convincing. Two of the most important contributions to the creation of such a framework have been made by Austin 1962 and Searle 1969. In this paper, I want to discuss some of their respective contributions critically and suggest some ways in which they might be improved.

1 AUSTIN

I turn first to a discussion of Austin. Austin 1962 is a work which was published posthumously by Austin's students and can therefore not be regarded as fully representative of Austin's views had he been given time to finish his work. Austin proposed a number of distinctions which have inspired a substantial amount of reasearch on language use during the past 25 years.[2]

Among other things, Austin suggests that we should distinguish the locutionary aspect of an utterance from its illocutionary and perlocutionary aspects. To be more precise, Austin claims that in uttering a sentence, one concomittantly produces three acts: a locutionary, an illocutionary and a perlocutionary act.

Austin 1962, 108:

> '/performing/ a *locutionary act* ... is roughly equivalent to uttering a certain sentence with a certain sense and reference, which is again equivalent to meaning in the traditional sense. Second, we said that we also perform *illocutionary acts* such as informing, ordering, warning, undertaking, etc., i.e. utterances which have a certain conventional force. Thirdly, we may also perform *perlocutory acts*: what we bring about or achieve by saying something, such as convincing, persuading, deterring and even, say, surprising or misleading'.

My first objection concerns the choice of the term *act*. This term gives the impression that Austin is talking about temporally distinct activities rather than simultaneous aspects of one and the same action.[3] Further, it is unfortunate that Austin only discusses the distinction as applied to linguistic utterances. It seems fairly clear that the distinctions he is after apply to communicative actions in general including non-verbal ones and not merely to linguistic communicative activity.

Secondly, I would like to discuss in some more detail what aspects of an action Austin's distinctions really concern. The locutionary aspect seems to correspond to the conventional content, i.e. to whatever information is tied to an utterance by convention. The illocutionary aspect is said to be identical with something Austin calls the conventional force of an utterance.

(1) It's snowing

Thus, in (1), the locutionary aspect of the sentence says something about the weather conditions while the illocutionary aspect of (1) is its conventional force as a statement. But what do we do about a sentence like (2) below?

(2) I promise to buy you a drink.

(2) by convention seems to be both a promise and a statement. Furthermore, the fact that it is a promise seems to be derivable from the conventional content of the word promise and the fact that (2) is an indicative statement. A speaker is obliged to vouch for the truth of all statements he makes, so that if he states that he is promising, i.e. states that he is committing himself to some future action, then he is obliged actually to commit himself if he is to tell the truth. His statement that he is promising commits him to promise which in turn means that he has committed himself to carry out a future action. Thus, the actual force of (2) is derivable from the conventions governing the making of statements in conjunction with the conventional content of the word promise. Therefore, our knowledge of what kind of communicative action (2) is to count as derives from our insight into the locutionary dimension of (2). This does not mean that the locutionary aspect can be equated with the illocutionary aspect, it just means that we often recognize our utterances as being of a certain type of action through the conventional content of the words

we employ. (2) could, of course, be used for other purposes than promising, e.g. as an example in a linguistic article. So, recognition of illocutionary force is often a function of, among other things, comprehension of the locutionary dimension of an utterance.

Next I want to turn to the question of in what sensee illocutionary forces are conventional.

(3) There is a bull in the meadow.
(4) I warn you there is a bull in the meadow.

If we accept what has been said above about sentence (2), it is comparatively clear how (4) can be taken as a warning. The lexical content of warn in conjunction with the indicative form of (4) makes it natural to think that (4) has the force of a warning. As far as I can see, the only conventions that are required to reach this result are the one connecting indicative form with stating and the one connecting the sound sequence warn with a content roughly identical with 'making somebody aware of possible danger or unpleasantness connected with an expected course of action'. No specific conventions for warning other than the lexical conventions connecting the word warn with its content are really required. But this lexical type of convention does not seem to be a suitable candidate for the kind of convention which, according to Austin, is supposed to constitute acts of warning. It seems that the notion of conventional force[4] which is rather explicable in highly institutionalized contexts, like religious or legal activity, as the set of social consequences of a certain action does not allow an equally neat explication in less institutionalized situations. Compare the social consequences of an act of baptism with those of an act of warning. At least in traditional Christian societies, the act of baptism has been tied to very definite rights and obligations, but it is hard to find any social consequences connected with a warning, over and above those it has by virtue of being a statement, i.e. a commitment to a certain representation of reality. This becomes even more obvious if we consider cases such as (3). It is easy to imagine that a sentence like (3) might function as a warning. But is this due to any special convention for warnings? Does it make sense to say that (3) has the conventional force of a warning? What is at stake in the case of (3) seems instead to be the natural connections most of us can imagine between what is designated by the conventional content of (3) and some individual being conscious of possible danger connected with a certain course of action. No other conventions seem to be required.

Thus, for cases of 'illocutionary force' that are not tied to so-called performatives occurring in highly institutionalized contexts, we seem to have two cases:

1. The illocutionary force is explicitly indicated by a lexical item. In this case, there are two types of convention involved, namely:

a. Lexical conventions operating on the locutionary level tying certain lexical items to certain contents and

b. Modal conventions[5] connecting what linguists usually call mood (a certain syntactic arrangement or specific type of verbal affix) with certain communicative actions. In English, there seems to be at least three such connections: The indicative form is connected with stating, the interrogative form with questioning, and the imperative with requesting or ordering[6].

However, neither the lexical conventions nor the mood conventions directly constitute the illocutionary force of such acts as promising or warning. Rather, these two types of conventions together make it possible to derive what the force of a certain utterance containing a mood marker and lexical items like illocutionary verbs reasonably should be.

2. In the second case, such as (3), there is no explicit lexical indication of force. Instead, what enables us to derive the force of utterances such as (3) seems to be the natural connections that obtain between the conventional content of such an utterance and a specific type of communicative action such as warning. Thus, in order to explain that (3) can function as a warning, no specific conventions for the illocutionary force of warnings is needed. We only need to understand what it means to warn somebody.

But if what makes (3) or (4) into warnings is not conventional illocutionary force, it is reasonable to ask the more basic question: What is it that makes a certain utterance or, more generally, an instance of communicative behavior into a communicative action of a specific type? The notion of force does not seem to be of much help outside institutionalized contexts.

The answer I would like to suggest to this problem is that the identity of a communicative action should be determined in exactly the same way as the identity of other actions. To the extent that our ordinary concept of action suffers from a certain unclarity, so will our notion of communicative action.

There seems to be at least four common ways of identifying an action. One way is to identify an action through the effects or results of the action. This first type of identification does not necessarily have anything to do with the kind of action an agent thinks he is performing, i.e. an agent who is driving a car can be said to be polluting the air even though this is not his intention in driving the car. This type of identification of an action therefore depends on the interpretation an observer or the agent himself can give of the effects of a certain type of behavior, irrespective of whether they correspond to the agent's intentions or not.

A second type of identification relies on the intentions and purposes an agent connects with an action, irrespective of whether they are achieved or not. An argument for this type of identification is that it makes it possible to speak of an agent as performing a certain action before the purpose of the action has been achieved. For example, it is possible to say of a person A that he is making a chair before the chair has been finished.

A third type of identification is tied to the overt form of behavior an agent exhibits in performing an action. This type of identification acquires special strength when some overt form of behavior is connected by convention with the performance of a certain action. For example, we would use this criterion if we claimed that a rhetorical question is indeed a question since it occurs in interrogative form, even though it is intended as a statement and therefore, by the criterion of intention, should be classed as a statement.

Fourthly, identification can sometimes be accomplished solely on the basis of contextual extrapolation. Some behavior can be classed as action of a specific type just because it occurs in a certain context. The communicative action labelled *answering* at least in the widest everyday sense of the word seems to be of this type. Any verbal behavior that follows a question is in this sense an answer. For example (6) below would be counted as an answer to (5) even though it is irrelevant to the purpose of (5).

(5) What time is it?
(6) My puppy is ill.

It is not clear how Austin's notion of illocutionary force, which primarily seems to be an extrapolation from institutionalized performatives, can be related to these four criteria. Can the illocutionary force of a warning be identified with

1. the intention to warn, i.e. with the intention of evoking awareness of danger in somebody,
2. some specific type of overt behavior,
3. certain specific contexts or
4. some person actually being warned, i.e. becoming aware of danger connected with his course of action?

Since I think the answer in all cases is no[7] for non-institutionalized performatives, it is difficult to see just what role the notion of illocutionary force can play in a theory of communication which includes non-institutionalized communicative actions.

Let me now turn to Austin's notion of perlocutionary act. Unfortunately, this notion retains the ambiguity noted above between intended effect and actually achieved effect.

Austin 1962, 101, writes:

> 'Saying something will often, or even normally, produce certain consequential effects upon the feelings, thoughts or actions of other persons: and it may be done with the design, intention or purpose of producing them; ... We shall call the performance of an act of this kind the performance of a *perlocutionary act* or *perlocution*.

As we see, this ambiguity is not resolved. Things are made even more difficult by the fact that Austin included in the illocutionary force of an act its 'pure uptake' by a receiver. The distinction between illocutionary and perlocutionary acts would have been easier to maintain if all receiver reactions had been counted as perlocutionary effects.

It should perhaps be noted that the difficulty of distinguishing between intended and achieved effect would also adhere to an attempt to characterize illocutionary force in terms of the social consequences of an action, since one should then distinguish between intended and achieved social consequences.

Thus, while I fully acknowledge Austin's pioneering contribution to the study of the relationship between action and communication, I am somewhat critical of certain aspects of his account. Either the concepts he has proposed should be further explicated and clarified[8] or a new terminology and conceptual framework should be adopted. In what has been said above, I have made some suggestions in the latter direction. In sum, I would like to propose that the following features of communicative and other actions be considered as a more suitable conceptual framework for the study of communicative actions.[9]

1. The intention and purpose (intended effects) of a communicative action.
2. The actual overt behavior used to perform the communicative action.
3. The context in which the communicative action is performed.
4. The actually achieved effects in a receiver of the act of communication (these effects need not be identical with the intended effects).
5. As an extension of 4, the notion of conventional force, i.e. the social consequences of a certain communicative action.

2 SEARLE

In Searle 1969, 24-25, the author presents a theory which is a development of the account presented in Austin 1962. Searle claims that four acts are characteristically performed in the utterance of a sentence:

(p.24) a. Uttering words (morphemes, sentences)
= *performing utterance acts*
b. Referring and predicating
= *performing propositional acts*
c. Stating, questioning, commanding, promising etc.
= *performing illocutionary acts*

(p.25) d. 'To these three notions, I now wish to add Austin's notion of the *perlocutionary act*. Correlated with the notion of illocutionary act is the notion of the consequences or effects such acts have on the actions, thoughts or beliefs etc. of hearers. For example, by arguing I may *persuade* or *convince* someone, by warning him I may *scare* or *alarm* him, by making a request I may *get him to do something*, by informing him I may *convince* him, *enlighten*, *edify*, *inspire* him (*get him to realize*). The italicized expressions above denote perlocutionary acts'.

If we substitute 'utterance act and propositional act' for locutionary act, I believe most of the problems discussed above with Austin's theory also apply to Searle's theory. Searle himself points to the difficulties with the act terminology (Searle 1969, 24), but retains it all the same. In fact, Searle makes things a little worse since he introduces the term *speech act* where *act* must stand for a whole which is composed by the locutionary, illocutionary and perlocutionary acts. Furthermore, the term *speech act* is unfortunate since it would seem to restrict Searle's claims to communication via speech, whereas in fact most of his arguments are equally valid for non-verbal warnings, refusals, denials and affirmations.

The difficulties found in Austin's notion of illocutionary force are also present in Searle's treatment. It remains unclear to what extent illocutionary forces are conventional, intentional or tied to achieved effects, overt behavior or context. Searle also gives a number of conditions for certain particular speech acts that he believes should be met if the act is to be felicitous. I think these conditions are generally correct but misleading in that, as a rule, they make general features of action and communication into particular features of particular speech acts.[10] I will now summarize these conditions as they appear in Searle's analysis of promising in chapter 3, Searle 1969, and then comment on each one.

1. Normal input and output conditions:
   Communication is supposed to be literal and serious and to take place between a sender and a receiver who are physically and physiologically able to communicate.

Comment: This seems to be a general requirement on communication (and this is mentioned by Searle). The only objection I have to this condition is that Searle assumes that verbal communication normally is literal. As far as I can see, this is the exception rather than the rule.

2 and 3. Propositional content conditions:
   2. The utterance act should express a proposition.
   3. The proposition predicates a future action of the speaker

Comment: Searle uses the term *proposition* in such a way that questions and imperatives also can be said to express propositions. While I agree that there are similarities between the contents of questions, imperatives and statements, I do not think the best way to capture this similarity is through the notion of proposition, which has a relatively clear explication in relation to statements, but not in relation to questions and imperatives.[11]

The predication of a future action of the speaker is a consequence of the meaning of the word *promise* and the fact that the speaker is making a statement about himself, a statement that he is promising, that is, undertaking an obligation to perform the action indicated in the subordinate clause. Since there are no time-machines, the action will have to be a future action. Similar restrictions on the content will be derivable from the meaning of other speech act verbs and general considerations of the nature of the world around us.

4 and 5. Preparatory conditions:

4. The speaker assumes that the hearer wants him to perform this action; and the hearer actually does want him to perform it.
5. It is not obvious to both speaker and hearer that the speaker will perform the action anyway.

Comment: 4 does seem to bring out a trait which is specific to promising, i.e. that promising, as opposed to threatening or scaring, does seem to be a communicative action which requires the speaker's *ethical consideration* of the receiver.

Condition 5, however, is due to a much more general tendency in human behavior, namely that one's behavior should have purpose and point and that one should not spend more energy than necessary on anything.

6. The sincerity condition:
The speaker intends to perform the action his expressed proposition predicates of him.

Comment: This again seems to be a very general condition having to do with the fact that most communicative acts by convention convey information about a certain attitude of mind or motive that is supposed to be expressed by the communicative act in question. Further, it is bad to be unethical: not having the attitudes one by convention is supposed to have in performing a certain communicative act would be to deceive, and deception is unethical. Thus, condition 6 is really a general ethical requirement on communication to the effect that it should not be deceptive.

7. The essential condition:
   The speaker intends that his utterance should place him under an obligation to perform the action in question.

Comment: This condition derives directly from the meaning of the word *promise* and the fact that the speaker is making a claim about himself. In general, when a speaker makes a claim, he is under obligation to vouch for the truth of the claim, which in this case entails that he regards himself under an obligation. To place oneself under an obligation is a social phenomenon which is created by convention. But it is a phenomenon which is much wider than promising. Promising is a communicative action which seems to involve a combination of (i) ethical considerations of the receiver and (ii) obligation undertaken to perform an action on behalf of the receiver. The word *promise* is then by lexical convention tied to this combination. Thus, the conventions involved are on the one hand lexical ones and on the other conventions creating the possibility of undertaking obligations. Only the former are specific to *promise*. The obligation created by uttering a sentence like *I promise to go* are thus due to the conventional force tied to the declarative mood and the use of the word *promise*.

8. The non-natural meaning condition:
   The speaker intends the hearer to realize that the speaker is placed under an obligation to perform the action in question by his utterance, and that the hearer's realization of this should be by virtue of his knowledge of the meaning of the speaker's utterance.

Comment: As Searle points out, Grice 1971 is the source of condition 8. If Grice is right, then this condition is a feature of all communication and not specific to promising (this is also implied by Searle) or for that matter to verbal communication or communication with conventional content.

9. The defining condition:
   The speaker's utterance is a correct and sincere promise if conditions 1-8 obtain.

Comment: This condition is correct. But this is not due to any specific conventions for promising. Rather, it is due to the lexical meaning of *promise* in conjunction with certain general features of action and communication. The only special social conventions that have to be invoked, besides those of a purely lexical nature, are those that make it possible for an individual to take responsibility for a certain representation of reality.

Thus, it seems to me that Searle's analysis should be seen as an elegant characterization of how certain general conditions on action and communication interact with the lexical content of certain communicative activity verbs and with the conventional force connected with certain mood markers. Such an analysis is valuable since it is of interest to find out exactly what combinations of general conditions and idiosyncratic factors that can be denoted by the various communicative activity terms of a natural language. Analogously, it is important to characterize exactly the factors that help to constitute human communicative action.

Finally, a few general remarks. Austin's and Searle's approaches have in common that they concentrate on single communicative acts. I think there is a certain danger inherent in this, namely that it is easy to lose perspective on communication as a whole. After all, communicative acts seldom occur in isolation, but rather sequentially in interaction. It might therefore be better to study larger chunks of communication, a study for which we might use Wittgenstein's term language games.

Secondly, there is always a danger that the analysis of communication becomes too linguistic by focusing on the meaning of certain communicative activity verbs. The analysis of such meanings should be as clearly separated from the study of actual communication phenomena as possible. If this can be accomplished, the results will probably be positive in both directions. Not least linguistically, since we would then get a better idea of the conceptual parameters that underlie the lexical field of communicative activity terms.

What then should be salvaged and further developed in the work of Austin and Searle? At least the following three areas seem to be of some interest:

1. The study of different communicative intentions,
2. The study of the various psychological and behavioral reactions characteristically evoked in a receiver during communication, and
3. The study of social consequences of acts of communication.

All three factors should then be correlated on the one hand with biological and psychological factors in human beings and on the other hand with material conditions and social power and solidarity relations in society at large.

FOOTNOTES

1 See Morris 1938 for the distinction between syntax, semantics and pragmatics.

2 As far as I can see, the changes made in the new and revised edition of Austin 1962 (ed. by M. Sbisà and JO Urmson) do not have any essential implications for the points I wish to raise with regards to Austin's work.

3 This point has also been noted by other authors, see e.g. Wunderlich 1974, 324.

4 See Allwood 1976, 122 for further discussion of this point.

5 A more thorough discussion of modality is given in Allwood 1976, 124.

6 For an argument that 'the exclamative' should be included as the mood for sudden expression of feeling or attitude see Quirk et al. 1972. Since the subjunctive has such a limited use in English, I find it hard to understand its precise function. However, I think it can at least partly be analyzed as a marker used to indicate neutralization of statement status.

7 I am not discussing here formal warnings such as can be given by parking attendants or the police. These have a conventional, legal force and very often a strict conventional form.

8 For a proposal of this kind see Wetterström 1975.

9 For more detail as to what this proposal entails see Allwood 1976, esp. chapters 7, 8, 9, 10 and 14.

10 See Grice 1967, lecture 1, for criticism in a similar vein.

11 See Allwood 1976, chapter 7.

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OPERATIONAL GRAMMARS

ÖSTEN DAHL

1 In this paper, I am going to discuss grammars for natural languages of a type that I will call *operational grammars*. First, I will try to give a preliminary definition of what I mean by this term. Then, I will discuss the ways in which such a grammar would be different from transformational grammars. I will also discuss in some detail the form that the rules of an operational grammar will have. Earlier grammatical models that are close to or can be subsumed under operational grammars will also be considered.

The paper should not be looked upon as an attempt to establish the superiority of 'operational grammars' over any other type of grammars. The rules that I am going to formulate are intended as illustrations rather than definitive proposals.

2 Operational grammars have so far been used most extensively for giving formation rules for the formalized languages of logic. A development which emanates from this field, but which has also been applied to natural languages, is found in so-called *categorial grammars*. The work of Richard Montague,[1] which contains the most elaborate applications of the operational model of grammar to natural language so far, builds partly on this tradition. As I will show below, models close to operational grammars have also been proposed within linguistics proper, notably by Charles Hockett 1954 .

3 An operational grammar is a generative grammar in the sense that it generates (defines) the set of grammatical (well-formed) expressions of a language. A complete operational grammar will also provide, for each expression, its interpretation.

This aim is attained in the following way: The grammar enumerates the set of basic expressions and assigns to each expression a grammatical (syntactic) category. Further, it describes a set of grammatical operations, by which derived expressions are obtained from the basic ones (directly or via other derived expressions).

To each basic expression, a complete operational grammar will also assign an interpretation. In such a grammar, each grammatical operation corresponds to a semantic operation, by means of which the interpretations of derived expressions are obtained.

4. We shall need to consider the notion of a grammatical operation in some detail. To begin with, we shall discuss briefly some aspects of categorial grammars.

One of the main ideas - perhaps the main idea - that has inspired the constructing of categorial grammars is that some categories of expressions can be defined in terms of the role they play in building up complex expressions from simpler ones. For example, the category of intransitive verbs can be defined as the category which, when joined to a noun phrase, yields a declarative sentence. This relationship is expressed by saying that intransitive verbs belong to the category S/NP (various other notations are also used). Ajdukiewicz 1935 calls categories that are defined in such a way 'functor categories'. A 'functor', he says, "is the same as a 'functor sign', or an 'unsaturated symbol' with 'brackets following it'". There is an ambiguity hidden in this definition, which is crucial for the problem we are discussing. We can associate the category of intransitive verbs with a set of functions from noun phrases to sentences. The term 'functor' can then be taken to refer to either the verbs themselves or to the functions that are associated with them. The expression 'functional sign' makes one think of the first possibility, the expression 'unsaturated symbol with brackets following it' rather suggests the second. I am not sure which interpretation Ajdukiewicz intended or whether he had made up his mind on this point at all. Reading his article, one gets the impression that the first interpretation is the one he leaned towards.

The choice between the two is important, though, since the generative power of the grammar may depend on it. If the first alternative is chosen, one is easily led to the conclusion that the grammar can only generate expressions that are concatenations of a functor expression with one or more argument expressions. If, on the other hand, we interpret 'functor' as meaning 'a function from expressions to expressions', we can also allow expressions that are built in other ways.

Bar-Hillel 1964 showed that categorial grammars are weakly equivalent to phrase-structure grammars. Clearly, this result presupposes that one understands the concept of a functor in accordance with the first alternative rather than the second. The second view, on the other hand, is taken by Curry 1963 , according to whom a functor is 'any kind of linguistic device which operates on one or more phrases (the argument(s)) to form another phrase'. This definition means that in Curry's theory 'what Harris and Chomsky call transformations are also functors'. With such a conception of functors, the generative power of a categorial grammar will presumably be equivalent to that of a transformational grammar. Of course, the theory should then provide means for formalizing the different kinds of linguistic devices which are to be subsumed under the category of 'functors'.

In Montague grammar, a main type of syntactic operation[a] is constituted by 'the rules of functional application', which are all of the form:

(1) If α is of category A/B and β is of category B, then $F_n(\alpha,\beta)$ is of category A.

where n is the index of a syntactic operation. For example, sentence adverbs such as necessarily are introduced in Montague (1973) by the rule

(2) If $\delta \in P_{t/t}$ and $\beta \in P_t$, then $F_6(\delta,\beta) \in P_t$

where P_t is 'declarative sentence'. As the term 'functional application' indicates, this is the process of applying a 'functor' to its argument. Each syntactic rule of 'functional application' corresponds to an analogous semantic operation. To the extent that expressions in Montague grammar are derived in this way, Montague's is a categorial grammar.

Not all syntactic rules are of this form, however. For example, conjoined terms (noun phrases) are obtained by the following rule:

(3) If $\Phi, \psi \in P_t$, then $F_8\ (\Phi, \psi) \in P_t$, where $F_8\ (\Phi, \psi) =$ $\underline{\Phi \text{ and } \psi}$, $F_9\ (\Phi, \psi) = \underline{\Phi \text{ or } \psi}$.

Thus, we see that there are at least two ways morphemes or words can be introduced in the grammar. The first is exemplified by sentence adverbs such as necessarily, which is listed in the lexicon as belonging to the category $B_{t/t}$ ('basic sentence operator') and which is introduced by the rule of functional application which is connected with that category ((2) above), and the second is exemplified by the conjuction and which does not by itself belong to any category but is introduced directly by a syntactic rule, as the 'marker' of a syntactic operation.

Thus, given a morpheme α in the language such that for any expression β belonging to the category B, the complex expression $\alpha\beta$ belongs to category A, there are two choices within an M grammar:

(a) to assign α to the category A/B and derive $\alpha\beta$ by a rule of functional application (i.e. of the form (1))

(b) not to assign α to any category at all but to postulate the following syntactic rule:

If β is of category B, then $\alpha\beta$ is of category A.

It may legitimately be asked what the criteria are for choosing in each particular case between (a) and (b) and whether it is meaningful to make the distinction between the two alternatives at all. In other proposals for categorial grammars, many of the expressions which are introduced according to (b) in Montague's theory are treated along the lines of (a). It seems that the cases where Montague chooses (b) rather than (a) tend to be those which involve something more than just the concatenation of two expressions. However, given Curry's concept of a functor - 'any means of forming new expressions from old ones' - it is not clear why we could not use the (a) alternative even if the derived expression has a more complicated structure.

It is instructive to follow the development of one syntactic operation - negation - in Montague's own theory. In Montague 1970a , not was said to be a 'basic adformula phrase'- i.e. a sentence adverb - on a par with necessarily. A consequence of this is that the grammar generated sentences such as John loves Jane not - what Montague termed 'an archaic style of negation'. In Montague 1970b , the desire to capture also 'the more modern form' John does not love Jane forces the author to introduce two operations that join subjects with verb phrases - one for affirmative and one for negated sentences. In Montague 1973 , negation is combined with tenses (present, future and perfect) so as to yield six different sentence-creating operations. Thus we see how Montague himself vacillates between the two alternatives (a) and (b).

I now propose that the choice between the alternatives (a) and (b) is no meaningful question, and that (a) and (b) are just two ways to express the same idea.

The solution I want to follow is roughly along the lines of Curry's (1963) - the differences are mainly terminological. What I want to suggest is that people have been misled by thinking of formulas such as S/NP primarily as categorisations of expressions - morphemes or combinations of morphemes -

rather than of syntactic operations - means of obtaining one expression from another. Thus, rather than saying that an intransitive verb 'belongs to the category S/NP', we should say that the primary function of intransitive verbs is to express (or 'perform' or 'mark') syntactic operations that create sentences from noun phrases. In other words, each intransitive verb is associated with a distinct syntactic operation. Every derived syntactic category in Montague's grammar will in this theory be associated with a set of syntactic operations rather than with just one. We shall refer to such a set of syntactic operations with the same syntactic properties as a *construction*. Each member of the category corresponds to one syntactic operation. Redefining the term 'functor' somewhat, we can say that an expression α is the functor of an operation φ if the value of φ is $\alpha\beta$ or $\beta\alpha$ for any argument β.[2] A functor in this terminology expresses a syntactic operation rather than being the operation itself.

Notice that my proposal, when applied to Montague's grammar, in addition to doing away with the necessity of having to choose between the two alternatives (a) and (b), makes it possible to use the notions of categorial grammar much more generally, thus making Montague grammars much more like 'pure' categorial grammars. In addition, there are some empirical facts about natural language that can be interpreted so as to give further weight to my proposal.

As we have already seen, the expressions that I have called 'functors' are derived in two quite distinct ways in Montague's grammar. If functors behave as a natural class in natural languages, then this finding would support my concept of the unity of the class, and argue against Montague's partitioning of it. I wish to argue that such is the case. As was first noted in Greenberg 1963 , the rules that determine the word order of different syntactic constructions in a language are not independent of each other. If a language uses a certain word order in one construction, we can often predict which word order it will use in a number of other constructions. For example, languages that place the verb after the subject and the object almost invariably have postpositions rather than prepositions, and tend to place negations[b], auxiliaries, modals, question particles etc. last in the sentence. In order to formulate a generalization here, we would like to define a category comprising all the grammatical classes we have enumerated and enabling us to say that for any language, functors tend either to precede or follow their arguments. Notice, in particular, that the category would have to include expressions derived according to (a) - e.g. verbs - and (b) - e.g. negations, conjunctions, and auxiliaries - in Montague's grammar.

The distinction in Montague's grammar between the two types of 'functors' resembles the traditional distinction between lexical and grammatical morphemes. However, it can be argued that this distinction corresponds to a graded scale rather than to an absolute dichotomy, and what is perhaps more serious, that members of the same category and even what is felt to be the same 'morpheme' can function now as grammatical, now as lexical morphemes. Thus, the auxiliaries will and have are at least in some sense verbs, thus belonging to a lexical category. In English, temporal and modal auxiliaries have rather peculiar properties, but this is a highly language-specific fact - there are lots of languages where there is no distinction between them and ordinary verbs. Indeed, have itself also has the function of a transitive verb, and it appears that to explain this as a case of homonymy would be to miss an important relationship. In the same way, prepositions sometimes function as markers of syntactic processes - e.g. by in passive sentences - and sometimes as words with a clear semantic content e.g. by in the sentence We live by the sea. These facts, in my opinion, speak in favor of treating functors as one natural class rather than dividing them into two completely unrelated categories.

Below, I will try to show how the fact that one category can have different functions can be captured in the grammar.

We should also note one consequence on the semantic side of choosing the Curryan version of categorial grammar. In Montague grammar, functors - i.e. expressions of A/B categories - are regarded as basic expressions, and should as such be assigned semantic interpretations. Consider, for example, sentence adverbs, like the ones introduced by (2). Each sentence adverb corresponds to a function from sentences to sentences. On the semantic side, there will be a corresponding function from interpretations of sentences to interpretations of sentences. Montague would say that a sentence adverb *denotes* the semantic function which it is associated with. What happens in a syntactic operation which joins phrases of category A/B with phrases of category B is, then, that we join a function-denoting expression with an expression denoting something in the domain of the function. However, there is *a priori* nothing that tells us that if we join a function-denoting expression with an argument expression, we get another expression denoting the value of the function - so that there must be an extra rule that tells us that. In a Curryan grammar, on the other hand, there is nothing that forces one to assign any interpretation at all to functor expressions qua expressions - they get their meaning only 'syncategorematically', i.e. in force of being part of constructions.[c]

5. We shall now consider the form of syntactic rules. A rule in the grammar specifies an operation or a set of operations. As we have said, a set of operations with the same syntactic properties is a *construction*. The syntactic rules for constructions must be complemented by a part of the grammar which will correspond to the traditional lexicon, where the individual operations that are basic members of the constructions are listed. When a construction has only one member, no reference to the lexicon is needed. We shall refer to such operations as *unique* operations.

Generally, rules will be of the form:

(1) If $\alpha,\beta,\ldots$ are members of the categories A,B,... and have the interpretation a,b,... respectively, then $\varphi(\alpha,\beta\ldots)$ is a member of the category C with the interpretation f(a,b...).[d]

Thus, the rule contains the following information:

(2) (a) the category membership of the input and output expressions (or operations)
    (b) how the *form* of the output expressions is derived
    (c) how the *interpretation* of the output expression is derived.

It is possible to divide the grammar into three 'components', which would contain the information under (a), (b), and (c) respectively. We can refer to these components as the categorial, 'spelling-out', and semantic components, respectively. However, it does not seem to be of any great importance whether we consider these as separate 'components' or not.

We shall concentrate here on the 'syntactic' part, i.e. the specification of the function φ.

The simplest case of a syntactic operation - when it is not the identity function on expressions - consists of the concatenation of some expression with the input expression. One example is the negation operation in propositional calculus. We can write a rule for this operation as follows:

(3) $\text{Neg}\ (\alpha) \Rightarrow {\sim}\frown\alpha$

The arrow can here be read 'is spelled out as' and $\frown$ is the concatenation sign. Neg (α) is an expression in the metalanguage read as 'the result of applying the negation operation to α". (Notice the difference between e.g. ~p - which would be an expression in the object language - and the metalanguage expression Neg (p)).

We say that ~ is the *functor* of the negation operation.[e] Generally, a functor is any expression β occurring in a rule of any of the following forms:

(4a) $\varphi\ (\alpha) \Rightarrow \beta ^\frown \alpha$

(b) $\varphi\ (\alpha) \Rightarrow \alpha ^\frown \beta$

(c) $\varphi\ (\alpha) \Rightarrow \gamma ^\frown \beta ^\frown \delta$ where $\gamma ^\frown \delta = \alpha$

However, as we have said earlier, it will normally be possible to simplify such rules both for formalized and natural languages. Consider a language where the 'unmarked' word order is functor-argument. In the grammar of such a language, we may introduce a syntactic *metarule* of the following form:

(5) $\varphi\ (\alpha) \Rightarrow F(\varphi) ^\frown (\alpha)$

(5) is read: The result of applying φ to α is the string which consists of the functor of φ to the left of α.

We introduce the convention that all syntactic operations follow this metarule if nothing is said to the contrary. This means that most of the rules for syntactic operations which have the general form of (3) will only need to specify the functor of the operation, e.g.

(6) F(Neg) = ~

Consider now constructions, i.e. sets of operations with the same properties. In uncomplicated cases, the members of a construction will only differ in what functor they are associated with. The functors will be listed in the lexicon (together with the interpretations of the respective operations), so, provided that the construction is spelled out in accordance with the metarule, we need not give any additional specification of it whatsoever.

As an example of a more complicated case, consider transitive verbs. They can be looked upon as the functors of operations which take noun phrases as their arguments and verb phrases (actually, the operations of which verb phrases are the functors) as their values. However, in many languages, we do not just concatenate the verb and the noun phrase. In English, the only problematic cases are those involving personal pronouns. We could, with Montague (cf. Montague 1973), account for case-marking by adding an extra clause to the rule stating that if the argument of a transitive verb-operation φ is he, she etc. the result of applying φ to the respective pronoun is not $F(\varphi)$ he but rather $F(\varphi)$ him etc. Clearly however, the difficulties with such an approach increase very rapidly as we proceed to languages with a more complicated morphology. It is also evident that, in writing a German grammar, we would be missing the point if we included into the rule for transitive verbs a specification of how the accusative of noun phrases is derived. The reason is that the accusative will turn up in a considerable number of constructions in the grammar, e.g. after prepositions. It will therefore be desirable to be able to specify the accusative forms of noun phrases in a single rule, once and for all. The natural way of achieving this result is to give the transitive verb rule as

(7) $\varphi(\alpha) \Rightarrow F(\varphi)\ \ \mathrm{Acc}(\alpha)$

and spell out Acc (α) in a separate rule, as a syntactic operation in its own right. According to this formulation, the spelling-out of one syntactic operation may involve another syntactic operation. In such cases, we shall talk about *primary* and *secondary* operations.

What is the difference between this proposal and saying that the transitive verb construction does not take noun phrases but rather accusative noun phrases as its arguments? The difference does not come out as long as we look only at the syntax, but it will be clear when we consider the semantic interpretation of the construction. Normally, any syntactic operation is interpreted as a semantic operation which is a function from the meaning of the argument expression. However, regarding the transitive verb construction as a set of operations which take the result of the accusative operation applied to noun phrases as their arguments would imply that the meanings of transitive verb phrases should be derived from the meanings of accusative noun phrases, which in turn should be derived from the meaning of ordinary noun phrases. But it is not evident that accusative noun phrases should be assigned meanings of their own, distinct from the meanings of other noun phrases. We can avoid assigning a meaning to the accusative operation if we regard it as a secondary operation, which is part of the spelling-out of (among other things) the transitive verb construction. Thus, only primary syntactic operations will be assigned a semantic interpretation; or in other words, the link between content and expression can be found on the level of primary syntactic operations.

Among the secondary syntactic operations, we will find most of the phenomena traditionally subsumed under morphology. It is not possible, however, to classify operations unequivocally as 'primary' and 'secondary': it may well be necessary to say that one and the same operation is primary in some contexts and secondary in others. We have already mentioned that some morphemes appear to function now as 'markers of grammatical processes' and now with independent meaning. Consider, for example, Chomsky's celebrated sentence:

(8) They decided on the boat

In one interpretation ('the decision was taken on the boat'), the prepositional phrase on the boat has to be assigned a semantic interpretation of its own, whereas in the other, on seems to have a function quite on a par with case endings such as the accusative. Thus, if we assume that we are dealing with the same operation in both cases, this operation will sometimes be a primary operation with an independent semantic interpretation, sometimes it will only be part of the spelling out of a more complex operation.

Presumably, this is also the way one should treat idioms or idiomatic expressions whose meanings are not functions of the meanings of their parts. The well-worn example kick the bucket 'die' can be said to have the semantic properties of an intransitive verb, but is syntactically a complex verb phrase. Therefore, we might consider it to correspond to a primary operation, which is spelled out by the same secondary operations which, if we interpret them as primary, would give us kick the bucket in the literal interpretation.

Quite naturally, there will be many cases in which the choice between an analysis involving secondary operations or only primary ones will be problematic.

The introduction of the concept of secondary operations makes necessary a number of amendments of notation and terminology. We defined 'functors' in (5). We may have rules of the following form:

(9) $\varphi(\alpha) \Rightarrow \beta{}^\frown\psi(\alpha)$

In such as case, we say that β is the *primary functor* of the operation φ, symbolized by $F_1(\varphi)$. We introduce the notation $\Phi'(\varphi)$ to signify a secondary operation such that $\varphi(\alpha)$ is the result of concatenating $F_1(\varphi)$ and the result of applying $\Phi'(\varphi)$ to α.

Accordingly, (9) may be re-written as

(9') $F_1(\varphi) = \beta$
$\Phi'(\varphi) = \psi$

if we assume that the ordering of the elements is determined by the metarules.

Let us take a concrete example. In languages with case-inflection, each preposition (postposition) usually 'governs' one specific case (sometimes, several cases with differences in meanings). For example, the German preposition *mit* is followed by a noun phrase in the dative. In the grammar, there will thus be a primary syntactic operation which turns noun phrases into prepositional phrases by adding *mit* to them which we shall symbolize as Mit. This primary operation involves a secondary operation of Dative formation, which we shall refer to as Dat. The following rules will then be given for Mit:

(10) $\mathrm{Mit}\ (\alpha) = \mathrm{mit}\ \ \mathrm{Dat}\ (\alpha)$

which can be alternatively formulated as:

(10') $F_1(\mathrm{Mit}) = \underline{\mathrm{mit}}$
$\Phi'(\mathrm{Mit}) = \mathrm{Dat}$

Our notation thus allows us to formulate rules to account for the phenomenon of 'government' or 'rection'. A related concept, which involves problems of a slightly different sort, is agreement. As an example, consider attributive adjectives, such as *red* in *red house*. Following Montague, we could regard such adjectives as functors of operations that form common noun phrases out of common noun phrases. In English, the formulation of the rule for this construction will not involve any special problems. In many languages, however, the adjective agrees in number, gender and case with the head noun. In other words, we cannot just say that the adjective is functor of the operation, rather, the functor is an inflected form of it. To simplify matters, let us consider a simplified form of Latin where there are only noun phrases in the singular nominative, so that adjectives agree with nouns in gender only. The grammar should then generate forms such as *parvus puer* 'small boy', *parva puella* 'small girl', *parvum mare* 'small sea'. Clearly, we do not want to associate each of the adjectival forms with a separate syntactic operation. Since the form of the functor is dependent on the choice of the head noun, we need a function which to each noun assigns a suitable form of any adjective. This function we call the agreement operation. The adjectival forms that we want to generate all consist of an adjectival stem + an affix. We introduce the term *functor base* and say that, for example, the adjectival stem parv- is the functor base of the operation associated with the adjective in question. We denote the functor base of an operation φ as $Fb(\varphi)$. Further, we introduce three gender operations, Masc, Fem and Neut, which assign to each adjective stem the masculine, feminine and neuter forms of the adjective, respectively. We also introduce a function - which is not a syntactic operation - which assigns one of the gender operations of each noun in the language, i.e. in traditional terms, assigns a gender to it (this information must evidently be given in the lexicon). We write Gen (α) for the 'gender operation associated with α'. We can now give the rules for the attributive construction:

(11) $F(\varphi(\alpha)) = Agree_{\alpha}(Fb(\varphi))$

(11) says that the functor of the operation φ for the argument is the result of applying the agreement operation to the functor base of φ with respect to α. There will then be a rule spelling out the agreement operation:

(12) $Agree_{\alpha} = Gen\ (\alpha)$

i.e. the agreement operation with respect to α is spelled out as the gender operation associated with α. Further rules will then spell out the particular gender operations.[f]

6 In this section, I wish to compare the notion of 'grammatical structure' implied by operational grammars to that found in transformational grammar.

To state the grammatical - or syntactic - structure of an expression in an operational grammar, we need to know
(a) what basic expressions have been used in deriving it,

(b) what operations have been applied to these expressions and in what order. It is easy to see that this can be represented by a 'tree diagram' (or an equivalent 'parenthesis notation'). The usual notation of symbolic logic of the general form illustrated by

F(x,y)

with the arguments enclosed in parentheses after the function sign, will do the job. Notice that the equivalent tree diagrams are 'dependency markers' rather than 'phrase markers', although these notations can be converted into each other.

Such a representation shows us the way that an expression is derived by the grammar, but it does not necessarily tell us very much about its actual form, since it does not specify how the syntactic operations are 'spelled out'. This information is given in the grammar. The representation of the grammatical structure can thus be regarded as a set of instructions to choose operations specified in the grammar of the language.

The fact that the actual form of the sentence cannot be inferred from the representation of its grammatical structure makes the representation resemble the 'deep structure' of transformational grammar. There is one important difference though: the elements of the deep structure are linearly ordered, whereas there is no such ordering in an operational grammar.

The two concepts of grammatical structure are discussed in Curry 1961:

> 'In this way, we may conceive of the grammatical structure of the language as something independent of the way it is represented in terms of expressions... Of course, this will need to be supplemented by a study of the way these phrases

> are represented by expressions. This gives us two levels of grammar, the study of grammatical structure in itself, and a second level which has much the same relation to the first that morphophonemics does to morphology. In order to have terms for immediate use, I shall call these two levels tectogrammatics and phenogrammatics respectively... Harris and Chomsky have suggested that grammar be divided into three stages, "phrase structure" grammar, transformation grammar, and morphophonemics. But if phrase structure grammar means the building up of phrases by concatenation of adjacent phrases, then it has a phenogrammatical aspect. From the standpoint of tectogrammatics, I see no reason to put phrase structure and transformation grammar on separate levels, nor to suppose that phrase structure operations necessarily either precede or follow transformation operations'.

The problem is taken up in the following passage from Chomsky 1965:

> 'The rules of the categorial component carry out two quite separate functions: they define the system of grammatical relations, and they determine the ordering of elements in deep structures... It has been suggested several times that these two functions... be more sharply separated, and that the second, perhaps, be eliminated completely'.

Quoting Curry 1963, somewhat misleadingly, as an adherent of set-systems, i.e. grammars containing rules of the form $X \rightarrow \{Y,Z\}$, where $\{Y,Z\}$ is a unordered set of expressions rather than a string, Chomsky goes on:

> 'Proponents of set-systems... have argued that such systems are more "abstract" than concatenation-systems..., and can lead to a study of grammatical relations that is independent of order, this being a phenomenon that belongs only to

> surface structure. The greater abstractness of set-systems, so far as grammatical relations are concerned, is a myth... A priori, there is no way of determining which theory is correct; it is an entirely empirical question, and the evidence presently available is overwhelmingly in favor of concatenation systems...'

Further, Chomsky argues that a 'set-system' must be supplemented by a set of rules which 'will assign an intrinsic order to the elements of the underlying unordered Phrase-markers' or, in other words, 'simply converts a set-system into a concatenation system'. Thus - Chomsky apparently wants to argue - since you have to order the elements sooner or later, you might as well do it at once. It is not clear that Curry's system is adequately subsumed under the 'set-systems' that Chomsky describes. A syntactic operation in Curry's grammar does not just string together two or more elements, it joins a 'functor' and its 'argument' or 'arguments'. Thus, the elements that are joined constitute ordered pairs rather than sets, although it would be misleading to call them'strings'. Since there is a relation between the elements - i.e. the functor-argument relation - it follows that there may be general rules that *interpret* that relation in terms of a left-to-right (or earlier-later) ordering. Of course, it is an empirical question whether such rules exist in natural language - but the existing evidence seems to be in favor of such a hypothesis. We have already had occasion to discuss Greenberg's word order universals, which suggest that there is in any language an 'unmarked' position for the functor in relation to its arguments.[3,g] It is not clear how such generalizations can be expressed in a phrase-structure grammar where the word order is determined separately for each construction.

Consider the following statement about human languages:

(1) In human languages, there are simple and complex expressions: complex expressions are always built up by concatenating simple expressions.

In the framwork of operational grammar, (1) says the following:

(2) The only possible grammatical operations are concatenation operations.

Another way of stating (1) is:

(3) Human languages can be fully described by phrase structure grammars.

In Chomsky 1957, the hypothesis formulated in (3) was analyzed and rejected. Chomsky's conclusion was that an adequate grammar for a natural language must in addition to phrase structure rules contain rules of another sort - transformation rules. It should be kept in mind, however, that it does not follow from the fact that phrase structure grammars are inadequate, that grammars should include a phrase structure component AND something else. It might be that they should include some entirely different sort of rules.

Phrase structure grammars were essentially a formalization of the ideas underlying IC analysis and 'parsing' - that syntactic analysis consists mainly of chopping up expressions into smaller parts. Indeed, one could say that (3) implies that the only interesting relations are '$\underline{x}$ is an immediate constituent of $\underline{y}$', '$\underline{x}$ is to the left/right of $\underline{y}$' and '$\underline{x}$ is a string belonging to the category $\underline{y}$'.

This, in its turn, is equivalent to (4):

(4) It is possible to represent all relevant information about the structure of a sentence in a phrase marker.

Chomsky argues effectively against such a theory. But in choosing an alternative, he makes 'the mistake of naive Platonism'. This concept needs some explanation.

Plato found out that an ontology that only countenances particular objects - e.g. individual horses - is not sufficient. We also need to postulate some more abstract entity to represent that which is common to all horses. Plato, however, thought that this abstract entity was simply another horse - albeit more perfect than the ordinary ones. This is what I call the'mistake of naive Platonism' - to think that the abstract underlying entities are of the same nature as the things they underlie. What Chomsky does is quite analogous. Finding that a phrase marker is not enough to capture the grammatical structure of a sentence, he simply postulates another phrase marker - the 'underlying P marker' or 'deep structure' as it was later called. This, however, means that although (4) does not hold, we can represent the grammatical structure of a sentence by a sequence of P markers. Chomsky never considers the possibility that what is needed may be a different conception of grammatical structure.

7 We shall now discuss the relations between operational grammars and the different versions of transformational grammar that have been proposed. As has been pointed out, e.g. in Partee 1972, there are some similarities between the type of transformational grammar proposed in Chomsky 1957 and operational grammars (Partee is talking about Montague Grammars). The optional transformations in Chomsky's theory - particularly the ones that introduce negated, interrogative and conjoined sentences, look very much like sentence-forming operations in an operational

grammar. It is interesting to notice in this connection that Chomsky sometimes uses a terminology which suggests a process or operation-oriented approach, cf. 'one of the most productive processes for forming new sentences is the process of conjunction' (1957, 35).

Chomsky was not interested in 1957 in constructing a semantic component for the grammar. This was first attempted by Katz and his associates. 'Kernel sentences', i.e. sentences that had not undergone any optional (singulary or binary) transformations, were supposed to be assigned semantic interpretations with the help of 'projection rules'. These rules worked in an 'inside-out' or 'cyclic' fashion, i.e. beginning with the ultimate constituents, performing some operation on the semantic 'readings' of the input strings to yield a 'derived reading' for the output string. This process is completely analogous to the way semantic rules are supposed to operate. The only difference would be that there is no demand in Katz' theory that there be a one-to-one correspondence between the semantic and the syntactic rules, rather 'there is a different projection rule for each distinct grammatical relation'.

The problems arise with non-kernel sentences. In Katz-Fodor 1964 'type 2 projection rules' are proposed to account for such cases.

> 'Suppose S has been constructed from a certain set of source sentences by the optional transformation T.
> A type 2 rule is a rule which operates on the semantic operations of these source sentences and on either the derived constituent structure of S or on the transformation T in order to produce a semantic interpretation of S'.

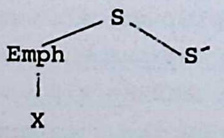
It is not entirely clear what such a rule would look like - there are no concrete examples in the paper, nor anywhere else, as far as I know - but it seems to be possible to interpret the formulations so as to make projection rules of type 2 quite analogous to the semantic rules of an operational grammar.

Already in Katz-Fodor 1964, there is a certain uneasiness about the type 2 rules. The reason was that a number of optional transformations were found not to influence meaning at all. Therefore, at least for them, projection rules of type 2 were superfluous. In Katz-Postal 1964, this type of rule is eliminated altogether in favor of type 1 projection rules, which exclusively operated on underlying P markers. In order to achieve this result, certain changes were necessary also in the syntactic theory. Sentence embedding was supposed to take place in what was now called the base component of the grammar and a number of'meaning-changing' singulary transformations were made obligatory by introducing so-called 'trigger-morphemes' (Q,I etc). As a result of this, the transformational component became semantically completely irrelevant - the celebrated 'Katz-Postal hypothesis'.

Let us look at the Katz-Postal hypothesis from the point of view of operational grammar. It seems clear that rules which were subsumed under the heading 'transformations' in Chomsky 1957 really should be regarded as radically different grammatical phenomena. For example, there is no reason why sentence pairs like John looked the number up, and John looked up the number , on the one hand, and He sings and Does he sing?, on the other, should be related by the same type of rule.

The question transformation, in terms of an operational grammar, is an operation that derives interrogative sentences from declarative ones. As noted above, we can represent the 'derivational history' of an interrogative sentence by writing $Q(S_1)$, where Q denotes the question operation and S_1 is some declarative sentence. The notation $Q(S_1)$ is of course equivalent to a 'T marker' - a diagram that shows the 'transformation history' of a sentence - within the 1957 version of transformational grammar. The introduction of the 'trigger morpheme' Q can be seen as nothing more than a partial coding of the transformational history of the sentence into its base structure - or in other terms, the insertion of an 'instruction' that a certain operation should be performed.[4,h] The problem for the Katz-Postal hypothesis as an empirical claim about natural languages is that such a coding-in is in principle always possible.

Let us elaborate this point. Comparing T-markers with Montague's 'analysis trees', Partee 1972 states that 'a T-marker can really be viewed as an analysis tree in Montague's sense'. This is not quite true. A T-marker of the type exemplified in Chomsky 1965, 130 shows which transformations a sentence has undergone: in a number of cases, however, one and the same transformational rule can apply to a sentence in several ways. Among the transformations proposed in Chomsky 1957, this would be the case, for example, with the rule that adds extra (emphatic) stress to some constituent the extra stress should fall on. In a grammar where we want all information to be contained in the base structure, we cannot in such cases just add a 'trigger morpheme' but must also mark the constituent in question in some way. A possible deep structure to 'trigger' the emphasis transformation might be something like the following:



where X is the stressed constituent of S'.

In an operational grammar, such transformations - i.e. those which apply to a certain constituent in a sentence - would have to be treated either as operations affecting some category of expressions other than whole sentences, or as two-place operations; one argument of the operation would be a sentence and the other the constituent that is to be singled out. A possible solution is proposed in Dahl 1974.

In the 'standard theory' of Chomsky 1965, the semantic interpretation of a sentence was wholly determined by its underlying structure ('the Katz-Postal hypothesis'). To account for a number of phenomena that seemed to fit badly with this theory, so-called surface structure interpretation rules were added to the model by Chomsky, Jackendoff et al. Adherents of 'generative semantics' on the other hand, suggested that 'derivational constraints' would be adequate for handling such cases.

Within the framework of a transformational grammar, counter-examples to the Katz-Postal hypothesis may be of two kinds:

(1) cases where the addition of a transformation to the derivation of a sentence is associated with a well-defined change in the interpretation of the sentence, i.e. where the transformation corresponds to a semantic function

(2) cases where the interpretation depends on what the surface structure (or some intermediate structure) looks like, independently of how such a structure was derived (in other words where two entirely different sequences of transformations could in principle lead to the same result).

Cases of type (1) do not cause difficulties for an operational grammar, at least not to the extent that we can identify transformations and grammatical operations. Cases of type (2), on the other hand, would contradict the principle of isomorphy between syntax and semantics, since they involve rules for semantic interpretation that do not correspond in a one-to-one fashion to anything in the syntax.

In the discussion, (1) and (2) have not been kept very clearly apart. As can be seen from the quotation above, Katz and Fodor seem to allow two possibilities for type 2 projection rules - they may operate either on the derived structure or on the transformation. They do not discuss these two possibilities, however. It is easily seen, though, that cases of type (1) and (2) might have to be treated differently in this respect.

If we look at the counterexamples to the Katz-Postal hypothesis which have been actually proposed, we find that they are, indeed, of two kinds. Thus, for example, sentences with focused constituents (JOHN killed Bill) have been claimed to demand surface structure interpretation rules. However, we could equally well say that what is interpreted is the 'emphatic stress transformation' that assigns extra stress to John. This would then be a case of type (1). Consider, on the other hand, the rules that have been proposed to determine the scope of quantifiers from their surface ordering. Here, it seems that a given ordering - with a given interpretation - could very well arise in quite different ways. Notice, however, that these rules have a somewhat different function than the rule that assigns interpretations to sentences with focused elements - they assign an order of preference between a number of *a priori* possible interpretations. It would be nice if all apparent counterexamples to the principle of isomorphy between syntax and semantics could be shown to be of this character.

8. Although the conception of operational grammar has mostly been used by logicians, one can also find parallels within linguistics proper. In Hockett 1954, 'two models of grammatical description' are offered, one of which, 'Item-and-Process' clearly falls under the definition of an operational grammar given above, except for having no explicit semantic component. Hockett gives the postulates of the IP model as follows:

> '6.1 A linguistic form is either simple or derived.
>
> 6.2 A simple form is a root.
>
> 6.3 A derived form consists of one or more underlying forms to which a process has been applied. The underlying forms and the process all recur (save for occasional uniquenesses) in other forms...

6.4 Some of the phonemic material in a derived form may be, not part of any underlying form, but rather a representation or marker of the process'.

We can see that 'simple form' corresponds to our 'basic expression', 'process' to our 'operation' and 'representation' to our 'functor'. Indeed, Hockett is quite explicit about the parallels between an IP grammar and a 'mathematical system' characterizable as 'consisting of a set of elements for which certain operations are defined'. In later linguistic discussion, the concepts 'Item-and-Process' and 'Item-and-Arrangement', introduced by Hockett, have mostly been referred to when discussing morphology, but it should be emphasized that Hockett intended them to apply to syntax, too. For example, he derives John saw from 'John and saw, subjected to the binary process of predication'.

Hockett's discussion of Item-and-Process (IP) and the other 'model of grammatical description', 'Item-and-Arrangement'(IA), is of some interest when comparing operational and transformational grammars. One sometimes sees statements to the effect that transforamtional grammar is a kind of IP grammar. Although it is true that many of the rule-types postulated in generative grammar can be looked upon as expressing 'processes' in a general sense of the word, there are also a number of parallels between transformational grammar and IA, as I shall now try to illustrate.

The basic idea of IA is that linguistic expressions can always be fully analyzed in terms of morphemes ('items') and their combinations ('arrangements'). (It is easy to see the similarity of this idea with the hypothesis that grammatical structure equals constituent structure). Of course, there are plenty of cases where such an analysis meets with difficulties. Hockett discusses the English verb form took (past tense of take). He enumerates the following possible solutions within IA:

'(1) took is a single morpheme, so that there is no morphophonemic problem
(2) took is a portmanteau representation of the two-morpheme sequence take and /ed/
(3) took is an allomorph of the morpheme which appears elsewhere as take, plus a zero allomorph of /ed/.
(4) took is a discontinuous allomorph /t...k/ of take, and is an infixed allomorph /u/ of /ed/.
(5) took is take plus a replacive morph /u/ ⇐ /ey/...'

After discarding (1) and (2) as unexplanatory, Hockett points out that (3) 'is arbitrary because it assigns to something that isn't there phonemically... a meaning which would more naturally be assigned to some location within the overt form took' and (5) 'is not valid within IA' since 'it calls an "allomorph" something which is not in conformity with the general definition of the term'. Reformulating Hockett's point, we could say that these solutions deprive what we have called the basic idea of IA of its empirical content, since it allows anything to be interpreted as a morpheme.

In an IP grammar, adding a suffix to a stem and changing the stem vowel are just two ways of performing a morphological 'process'. In the terms we use in this paper, suffixation and 'internal change', e.g. ablaut, would be types of secondary grammatical operations, i.e. operations that figure in the spelling-out of primary 'meaning-bearing' operations. Secondary grammatical operation would then be one cause of alternations in the shape of 'morphemes' e.g. take:took. Clearly, however, there are morphological alternations that must be treated in another way. Thus, we often get allomorphic variation which is conditioned by the environment in which the morpheme occurs. An example would be the indefinite article a:an in English, the form of which depends on whether the following word begins with a consonant or a vowel. Such alternations are most suitably described by 'context-sensitive rules' of the following form:

(2) X → Y in the environment:_______

The distinction between these two types of alternations is clearly made out e.g. in Bloomfield's Pāṇini-inspired paper (Bloomfield 1939).

(2) is of course the form phonological rules are assumed to have in generative phonology. (Notice also that a similar kind of rule would be the natural choice if we wanted to formalize an IA grammar).

The problem is that generative phonology assumes that this is the only kind of phonological rule, thereby obscuring the distinction between the two types of alternations mentioned above. Thus, Chomsky-Halle turn ablaut into a context-sensitive rule by postulating that it takes place 'in the environment' of a feature which is in its turn added by a context-sensitive rule which is triggered by the presence of the formative past. The two-step approach obscures the matter further, but it should be evident that allowing as 'environment' of a rule a feature the only raison d'etre thereof is to trigger that very rule is to make the concept of 'environment' completely empty.

9 The job of the spelling-out rules is to make it possible to derive the form of complex expressions given the input expressions of the operations involved. Since an operation may apply to its own output or to the output of an operation of the same type, the same spelling-out rule may in some cases apply several times to the same expression. For example, the construction that yields compound nouns in English will, among other things, involve a rule that assigns stress to the constituents of the compound. Clearly, this rule will sometimes have to be applied twice, the second time to its own output. This, of course, is the cyclical principle for rule application which is described in Chomsky-Halle 1968 and the main examples of which are the stress rules of English. The rules that they

give can be incorporated into a logical grammar more or less directly, the difference being that the rule that says 'assign primary stress to a primary-stressed vowel which is followed by another primary-stressed vowel in a noun', i.e. a context-sensitive rule that is triggered by a certain environment, will here be understood as a spelling-out rule for a certain syntactic construction. Informally, the rule can be given as 'in a compound noun, assign primary stress to the primary-stressed element in the first component'.

Notice that the cyclical principle for rule application, which, although being 'a very natural' principle (Chomsky-Halle 1968, 20), must be stated separately in the transformational theory, will follow automatically in an operational grammar each time an operation is performed twice in a derivation. The following footnote in Chomsky-Halle 1968, 18 is of some interest:

> 'Observe that the interpretive semantic rules must apply in accordance with essentially the same principle as the one stated for the phonological rules...In a sense, the transformational syntactic rules also meet a similar cyclic condition'.

Thus, 'cyclic' rules can be found in three of the four main components of the grammar according to the standard theory. It is only in the fourth component - the one containing the phrase structure rules, that 'top-down' rules are used rather than 'bottom-up' cyclical ones.[i]

10 As we have said earlier, the transformations of a transformational grammar can often be equated with operations that form sentences out of sentences. So far, there is no big difference between transformational and operational grammars. However, an operational grammar allows in addition to sentence-forming operations, also operations that form expressions of any other category out of expressions of any category. In many cases, the alternatives to such operations provided by transformational grammars are rather clumsy or unperspicuous. Often, the predominance of sentence-forming operations - i.e. transformations - in transformational grammars has also led to a preference for transformational solutions when other approaches would seem more natural. For example, nominalizing processes as they are treated in traditional grammar are easily reinterpreted in terms of operations that form nouns or noun phrases out of verbs or verb phrases. The most common solution in transformational grammar, however, has been to treat nominalizations as being derived from whole sentences. This approach has been criticized by Chomsky 1972, who proposes a 'lexicalist' solution. Halle 1973 develops a theory of word-formation along similar lines. Although the proposals are in a number of respects quite vague, it is clear that 'lexical redundancy rules' of the kind they postulate come quite close to grammatical operations as this concept has been defined above. Consider, for example, Chomsky's treatment of causative verbs:

> 'In other words, we postulate that there is a feature (+cause) which can be assigned to certain verbs as a lexical property. Associated with this feature are certain redundancy rules which are, in this case, universal, hence not part of the grammar of English, but rather among the principles by which any grammar is interpreted. These principles specify that an intransitive verb with the feature (+cause) becomes transitive and that its selectional features are systematically revised so that the former subject becomes the object. Similar principles of redundancy apply to the associated rules of semantic interpretation'.[5]

Thus, we see that what the redundancy rule does is to specify, for any verb V, the syntactic, semantic and (presumably) phonological properties of the corresponding causative verb as a function of the properties of V. It might seem, then, that the difference between the 'lexicalist' and the 'operational' approaches is only a problem of notation. However, the idea that a lexical item is a set of features, widely accepted in generative grammar, obscures a few things that show up in the operational approach. Basically, a causative verb for Chomsky is the corresponding non-causative verb plus a feature (+cause). Suppose we instead choose to say that there is an operation, say Caus, that operates on non-causative verbs to make causatives. What is the difference?

First, notice that the operational approach predicts that we should be able to apply new word-forming operations on the result of applying Caus to a verb. For example, in some language, we might have desiderative verbs. We should then be able to form desideratives out of causatives e.g. Desid(Caus(V)). The operational approach predicts that these cases will be distinct, but if we identify a lexical item with an (unordered) set of features, there is no obvious way of keeping them apart.[6]

It was shown a long time ago (Weinreich 1966, Bierwisch 1969) that it is not possible to represent the meaning of lexical items as an unstructured set of features. It is easy to find cases where the relation between a derived word and the word it is derived from cannot be described just by adding a feature to the semantic interpretation of the simple word. For example, consider the femine suffixes found in many languages with the meaning 'the wife of', e.g. the Swedish -ska found in majorska 'the wife of a major' (from major 'major'). Clearly, a majorska is not simply a feminine major as the addition of a feature (+Feminine) would suggest. Rather, the definition of -ska must have a form like the following: 'If N_1 is interpreted as X, then N_1-ska is interpreted as "wife of an X"'. Thus, the meaning of the complex word must be expressed as an operation on the meaning of the simple word. In the example cited above, Chomsky does not go into the question how causative verbs are interpreted, but it should be clear that this case is similar to that of -ska, since causation is a relational concept. Similarly, Halle 1973 notes that 'by adding the suffix -hood to nouns designating human beings, nouns are produced that designate a state or quality such as boyhood, priesthood etc... The word formation rule might, in this case, assign to the derived nouns the feature (+Abstract)'. However, priesthood does not denote an abstract priest but rather the state of being a priest. This calls for the use of an operator on the meaning of priest rather than just an additional feature.

The result of the instrusion of 'features' from phonology into grammar has largely been a tendency to syntactical and semantic atomism which reduces structures to heaps of unrelated elements. It is regrettable that this has been allowed to go on for so long a period of time.[7]

11 So far, we have mainly considered grammatical phenomena which are easily interpretable as operations in an operational grammar. We found that a number of transformations could be reformulated as sentence-forming operations in an operational framework. Similarly, a number of the phonological rules postulated in generative phonology could be regarded as 'secondary operations'. However, this does not mean that all the rules of a generative grammar are equally easily transferred into an operational grammar. The majority of cases remain problematic. Let us look at the transformations first.

To start with, it should be emphasized that no theory offers clear solutions for all or even most problems. If we look at the transformational rules usually postulated in transformational grammar, we find that the number of rules that are unanimously accepted is not very large. Competition between 'transformational' and 'base component' solutions is the rule rather than the exception. Let us only mention such cases as pronominalization[8], conjunction reduction[9], nominalizations[10], complementizers[11], negative transportation[12], subject raising[13], and extraposition[14].

Similarly, we should expect that there will be several possible solutions for each problem also in an operational grammar. To treat even the main problematic areas would demand ten papers this size rather than one. We shall only give a few hints here about possible ways.

We have already seen that some transformations can be looked upon as operations that form sentences out of sentences. The clearest cases are the singularly optional transformations of Chomsky 1957, that were later treated as obligatory transformations conditioned by 'trigger morphemes' in the deep structure. Other cases can, as we have said, be treated as 'secondary operations', i.e. operations without a semantic interpretation that are involved in the spelling-out of meaning-bearing, primary operations. We have mentioned agreement rules as examples of this type.

When discussing word-formation, we noted that transformations may also sometimes me reinterpreted as operations of other kinds than the sentence-to-sentence type. Thus, a number of transformations - notably Passive and Dative Movement - might be better looked upon as operations that form verbs out of verbs, or alternatively, operations that change certain properties of verbs, such as their 'case frames' and morphological shape.

When treating constructions which are similar but non-identical in constituent structure and similar or identical in meaning, the natural solution in transformational grammar has been to regard one of the constructions as 'basic' and to derive the other from it by transformations. For example, Chomsky 1957 derives a structure like (1) from (2) by a transformation T_{sep}:

(1) The police brought the criminal in
(2) The police brought in the criminal

Such an approach is not only natural but even necessary in the transformational format, if we assume that a verb phrase such as brought the criminal in is to be analyzed into the two elements brought in and the criminal. This is because the phrase structure rules must generate elements that belong together in adjacent positions. An operational grammar, on the other hand, is not forced to choose a solution where the particle in is actually moved. Instead, one can look upon brought the criminal in and brought in the criminal as alternative realizations of applying the operation corresponding to the verb bring(brought)in to the argument the criminal. In one case, the argument would be 'infixed', in the other, postposed.

Chomsky rejected grammars built on IC analysis, i.e. phrase structure grammars, because, among other reasons, they could not account for discontinuous constitutents. His way out was to add to the grammar a mechanism which created discontinuous constituents out of continuous ones. By choosing such a solution, he failed to see that what was wrong with the old theory was the mixing up of two things: adjacency in a string and syntactic 'belonging-togetherness'. (See Stenius 1973 for a similar argument).

Thus, it is not necessarily the case that an assumed transformation need correspond to any rule at all in an operational grammar.

In addition to transformations and phrase structure rules, a great variety of 'constraints' have recently been proposed in generative grammar: global conditions on transformations, deep structure constraints, surface structure constraints, shallow structure constraints etc. Most probably, some such rules will have to be postulated in an adequate operational grammar too.

We have already mentioned 'meta-rules', i.e. rules that will guide more than one construction. It appears probable that the notion of 'meta-rule' can be extended to cover also many of the cases where 'constraints' have been postulated.

We shall now turn briefly to phonology. In sec. 9, I pointed out that it is generally assumed in generative phonology that all rules are of the context-sensitive kind, and I argued that some of them should rather be looked upon as secondary grammatical operations. In sec. 10, I argued that such a treatment would make the 'cyclical principle' come out automatically. However, it does not follow that all phonological rules should be re-interpreted in this way. Notice, to begin with, that the evidence for cyclical application is quite scanty for all but a rather restricted set of rules. In some cases, a consistent cyclical principle - i.e. applying all necessary rules first to the innermost constituents, then to the bigger ones - would even yield incorrect results.[15] Also, a great number of phonological rules - especially of the 'allophonic' type - can certainly be formulated in terms of a pure phonetic environment. It would therefore seem plausible to assume that an operational grammar also would need a 'phonological component' of the type postulated in generative grammar, albeit a somewhat smaller one. This component would contain a number of rules which adjusted the output of the grammatical operations in various ways so as to be in agreement with the 'sound pattern' of the language in question - possibly formulable in terms of a set of phonotactic rules. Of course, there might also be rules of a more 'syntactic' character with a similar function. For example, some changes in word order which have the effect of putting 'fat things last', e.g. Heavy NP Shift and Relative Clause Extraposition, might be attributable to such rules.

A great number of phonological rules are somewhere between the typical 'morphological' rules such as Ablaut and the 'allophonic' rules, by applying in a 'context' that must be defined partly in phonological, partly in morphological or lexical terms. An example would be the rule that turns k (orthographic c or q) into s before a front vowel in Romance words (opaque - opacity). Such a rule might be formulable as a meta-rule that applies to a given set of operations when involving a certain class of lexical items. Rules of this type are typically blocked by certain morphological boundaries. Such a constraint might possibly be accounted for by restricting the domain of the meta-rule in some way. Thus, if we could single out the set of word-forming operations from among the set of all grammatical operations, it would be possible to formulate a restriction on a rule that it cannot apply across word-boundaries. This suggestion, which so far remains very tentative, should certainly be investigated further.

FOOTNOTES

1 Montague developed his linguistic theory in Montague 1970a, 1970b, 1973. (These and other papers have now been collected in Montague 1974). Further developments of Montague grammar can be found in e.g. Partee 1972a, 1972b, Thomason (ms.1972), Cresswell 1973, and the papers in Rodman 1972. It will be evident that the present paper owes a great deal to this earlier work.

2 This formulation ignores cases of infixing. See sec. 5 for further discussion of functors.

3 That individual syntactic operations may constitute exceptions to the general rule in particular languages - as is clearly the case - does not, of course, invalidate it.

4 This may be too rash a discarding of the 'abstract morpheme' Q. Baker 1970 explains wh-movement as a movement of wh-words to an abstract Q morpheme and claims to be able to account for Greenberg's (1963) observation that transformations that move question words (wh-movement) can only move them to the beginning of the sentence and do not occur in SOV languages. It is not obvious how one should restate Baker's hypotheses if we interpret Q as an instruction to perform the question operation. However, the facts are not entirely clear: as Baker notes, his explanation does not cover relative clauses, which behave very much like questions.

5 The clause 'an intransitive verb...becomes transitive' seems to be an unfortunate formulation of the proposition that if there is a corresponding intransitive verb without the feature (+cause), the verb with the feature is transitive (see McCawley (ms.)).

6 I think this observation was made by P. Kiparsky.

7 McCawley (ms.) notes that 'the one respect in which the influence of Aspects has been pernicious is that it has touched off a wave of promiscuous and mindless employment of syntactic features'

8 The transformational nature of pronominalizations was challenged in Bach 1970 (and in a great number of other places).

9 Wierzbicka 1967 argued that there is no such thing as conjunction reduction.

10 See Chomsky 1972.

11 That complementizers occur in deep structure was argued in Bresnan 1972.

FOOTNOTES (cont.)

12 Arguments against the existence of negative transportation (i.e. the rule that would relate sentences such as _I do not think he is smart_ and _I think he is not smart_) are found in Jackendoff 1971.

13 Chomsky has recently argued that Subject Raising does not exist (Chomsky 1971).

14 Emonds 1970 argues that extraposition should be replaced by its inverse, 'subject replacement'.

15 Suppose, for instance, that Final Devoicing in German applies cyclically. Then we would have to apply it to a singular form like _Rad_ before forming the plural, thus giving *_Räter_ rather than _Räder_.

ADDENDA (1977)

a Montague does not use the term 'syntactic operation'. His 'structural operations' seem to correspond instead to what is called 'secondary operations' in this paper. The term 'semantic operation', on the other hand, is used in Montague in a way which more or less corresponds to the way it is used here.

b 'Negations' were erroneously included in this list. For a discussion of negation in universal grammar, where it is shown that it behaves differently from the other categories listed here, see Dahl 1977.

c There is at least one serious problem connected with the kind of grammar proposed in sec. 4, which is in fact inherited from 'traditional' categorial grammar. Consider, for instance, a categorial grammar where the category N - 'noun' - is basic. The basic members of this category would then include e.g. dog, horse, house. We might now want to account for the fact that words such as father, name, capital are functionally equivalent to nouns when combined with a noun phrase (or rather a prepositional phrase, but we can ignore that for this discussion), e.g. father of John, name of Peter, capital of Sweden. We would then have a category N/NP. The problem is now that there is nothing in our grammar that corresponds to the traditional category 'noun', since our category N excludes nouns that take arguments. On the other hand, our grammar fails to make the distinction between 'noun' and 'nominal' or 'common noun phrase', since it says that father of John and dog belong to the same category.

The only way out would be to postulate 'zero-place' operations, i.e. say that dog, horse, house etc. correspond to zero-place common noun phrase creating operations. But this solution means that the idea that operations are something that creates new expressions from old ones cannot be upheld.

This problem was the main motivation behind more recent work, in which we have tended to abandon the term 'operation' in favor of 'matrix', although this term turned out to invite to various more or less incompatible interpretations. I shall now outline an alternative model in which the difficulties with the concepts 'operation' and 'matrix' can be overcome.

Let us suppose that the grammar specifies a set of *phrase categories*, each of which corresponds to (or, if we like to be reductionist, can be identified with) sets of well-formed expressions in the language. Examples of such phrase categories would be NP, VP etc. Further, we postulate for each phrase category a *lexical category* which consists of abstract entities called *lexemes* The role of lexemes is that of *indices* or parts of indices in the set-theoretical sense for the phrase categories, i.e. each lexeme is associated with a member or a subset of the phrase category. In the latter case, the index of an expression will also include one or more other expressions, its *arguments*. We see that a zero-place 'operation' or 'matrix' corresponds to the case when an expression is wholly determined by a lexeme.

When a lexeme functions as the index of a matrix, we can say that it is the 'head' of the matrix. This terminology may be misleading, since it suggests a concrete expression rather than an abstract entity like a lexeme. Also, apparent difficulties arise with 'headless' matrices, i.e. when the head of a matrix is already specified by its matrix category. Looking at lexemes as 'indices' of matrices may make it easier to see what a 'headless' matrix is: it is the matrix corresponding to the set of expressions which is wholly specifiable by the arguments of the matrix, where, in other words, the index is redundant. This may also make it easier to reestablish in a natural way the distinction between grammatical and lexical morphemes which was put in doubt in sec. 4.

d There is an unclear point in this schema: whether φ is to be regarded as an entity the definition of which is wholly formal. Actually, a clearer formulation of (1) would be: If α, β... are members of the categories A, B... and have the interpretation a, b ... respectively, then $F(\alpha,\beta)$ is a member of the category C with the form $\varphi(\alpha, \beta)$ and the interpretation f(a, b).

e This turned out to be a rather unhappy terminology, since 'functor' has been used in so many other ways by other authors. In later versions, 'head expression' was used instead.

f The treatment of agreement - and morphology in general - leaves a good deal to be desired. Thus, there is no indication as to what the rules are going to look like when several morphological categories are involved in the agreement process, nor what happens when agreement and government interact, as sometimes is the case. See Källström's 'Agreement rules for Swedish Noun Phrases' and my 'Swedish Operational Syntax' (this volume) for further discussion of questions of morphology.

g Vennemann has, in a number of papers, presented a theory of 'natural serialization', which also tries to account for Greenberg's universals by hypothesizing unordered underlying structures which are assigned order by general rules. I quote the formulation of this principle from Bartsch & Vennemann 1972:

'(178) The principle of natural serialization.
The natural way of serializing the operator-operand relationship of all complex expressions is from right to left in OV languages and from left to right in VO languages'.

$$\{\text{Operator } \{\text{Operand}\}\} \Rightarrow \begin{cases} [\text{Operator } [\text{Operand}]] & \text{in OV languages} \\ [[\text{Operand}] \text{ Operator}] & \text{in VO} \end{cases}$$

This looks very much like what I have said in the text of the paper. However, close reading shows that Bartsch & Vennemann actually have it the other way round compared to what would be implied by my discussion. I would say that in English, for example, which is a VO language, the unmarked order is that of functor-argument expression, whereas Bartsch & Vennemann say it is operand/argument/-operator/functor/. Such a claim is made possible by their unorthodox treatment of verb-object constructions. For them, the object is the operator and the verb the operand. I do not want to argue for or against this hypothesis, although it seems slightly counterintuitive to me (in particular when it is extended to regard modal verbs as operands rather than operators).

I would just like to point out that the hypothesis also seems to imply that noun phrases are the operators of prepositional phrases with prepositions being operands, and sentences are operators in subordinate clauses, complementizers being operands. I do not know if Bartsch & Venneman regard this as a desirable consequence, since they do not discuss the problem.

h Recently, Chomsky has suggested (see e.g. Chomsky 1975) that semantic interpretation rules operate on 'enriched surface structures' in which movement transformations have left behind so-called 'traces' which make it possible to recover the previous position of moved elements. In other words, instead of coding into the deep structure information about what transformations should apply, one codes into the surface structure information about the transformations that have applied. Except for this difference, the strategies are quite similar. Notice that several of 'enriched surface structures' suggested by Chomsky, e.g. those of passive sentences and wh-questions, are very similar to the categorial structures proposed in 'Swedish Operational Syntax' (this volume).

i In later versions of our grammar, we have assumed that the spelling-out rules in fact work in a 'top-down' fashion. The main motivation for this was that agreement rules seem to be easier to formulate that way. Cf.,however, the discussion of agreement in 'Swedish Operational Syntax' (this volume).

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SWEDISH OPERATIONAL SYNTAX

ÖSTEN DAHL

1 GENERAL

In this paper, we present a version of Swedish 'higher-level' syntax (i.e. the syntax of simple sentences down to the level of noun phrases) which is more or less identical to the version presented in Swedish in Dahl 1976.

The model of the syntax of Swedish outlined here is the result of work in the project 'Logically based grammar', and although the opinions and points of view are my own, I owe a great deal to discussions with other members of the project. I am also indebted to many other people for having commented on earlier reports, among whom I would like to mention Erik Andersson and Jan Anward.

2 THE PLACE OF SYNTAX WITHIN A GENERAL THEORY OF LANGUAGE

Language is a system of conventional rules which prescribe that certain acts - the production of certain sounds or written symbols - have a certain content. These rules thus define a set of possible acts of speech (or writing) which all have a certain *form* and a certain *content*. In most cases, these speech acts have an internal structure: they can be regarded as being built up by a number of simpler elements. Knowledge of these elements and of the rules governing how they are combined to make up complex utterances with definite form and content is necessary for being able to use the language: they are thus part of the 'competence' of language users.

Syntax abstracts certain aspects of this competence in that it does not concern itself with the content of the expressions that are used in speech acts. Some linguists and logicians claim that it is possible - and desirable - to pursue the study of syntax autonomously from the rest of the theory of language. Personally, I do not think this is feasible, but it often turns out to be useful to concentrate on one level of description in order not to get lost in the complexity of problems. This is my aim in this paper.

3 CATEGORIAL STRUCTURES

Using a computer-inspired terminology, we can say that a language user's competence consists of a large number of 'programs' for speech acts. In the simplest case, such a program specifies one single speech act (one morpheme utterance such as hi! or no) but in most cases, a speech act involves the choice of several programs and then there is a superordinate program which functions as a 'frame' for programs at a lower level (which in their turn may be 'frames' for other programs).

We call such 'frames' *matrices*. We use the term 'matrix' (somewhat sloppily) in at least two senses: on one hand, as referring to 'empty' frames, i.e. frames for which the programs on lower levels have not yet been chosen - in traditional terms, this use is approximately equivalent to 'construction'; on the other hand, as referring to frames together with the programs that fill them. In general, this ambiguity does not create any difficulties. Each matrix is supposed to have a *head* and a number of *arguments* (the number may be zero). A matrix with n arguments is an n-*place* matrix. The arguments of a matrix are also matrices (in the second sense). The head can be a matrix but is usually a *lexeme*, i.e. an element taken from the lexicon. The lexemes are thus the minimal 'program' or ultimate constituents in the linguistic competence. Lexemes belong to different *lexical categories* (word classes).

The grammatical structure of an utterance (its *categorial structure*) is given by indicating which lexemes it consists of and which matrices these lexemes enter into. For this purpose, we use a so-called *decimal list notation.*

Let us take a concrete example of such a notation. For the sake of simplicty, we shall not take a whole sentence but a verb phrase (in our terminology a *predicate*), slå Pelle 'hit P.'. The list notation consists in this case of four lines. The first line looks like this:

(1) PRED1 = VB10 (NP11)

To the left of the equals sign, we learn that the expression we are going to describe is a predicate. To the right, we learn that it is built up of a matrix with two elements, the head, which is a *verb*, and the sole argument, which is a *noun phrase* (the head is thus what is written before the parenthesis). The verb and the noun phrase are not specified until the following lines:

(2) VB10 = Slå
NP11 = PN110
PN110 = Pelle

Note that the categories are written with capitals and the lexemes with capital initial letters.

Here we see that the noun phrase itself is a zero-place matrix whose head is the proper name (PN) Pelle.

The numbers following the category names make it possible to find the line which *specifies* the matrix or lexeme in question. The numbering follows a 'decimal' principle: the items to the right of the equals sign have the same numbers as those to the left followed by a 0 (for the matrix) or another digit (for the arguments). This numbering has been chosen in order to make elements that belong together from a structural point of view appear together in the list. Sometimes, there are just too many digits and then we use a shortened notation that looks like this:

(3) PRED = VB0 (NP1)
VB0 = Slå
NP1 = PN0
PN10 = Pelle

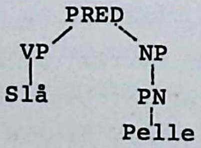
The first occurrence of the number 1 is thus deleted throughout, which means that the first item is unnumbered, and to the right of the equals sign, only the last digit is indicated.

In the grammar lower case letters (a, b, c...) are used as variables for the numbers in categorial structures. PREDa, NPb etc. thus denote an arbitrary predicate and an arbitrary noun phrase, respectively.

Each line in the list structure can be said to represent a *choice* by the speaker. Normally, every item that is introduced to the right of the equals sign should also be specified in another line furher down, but there are two exceptions. The first one is when the head of a matrix is already specified by the indication of its category (that is, the category has only one member - see for instance NEX in § 9). In such cases, the head does not get a number of its own. The other exception is when we are dealing with an *open* structure, i.e. a structure where the choice of a certain element is left unspecified. (In such cases, we are dealing with so-called binding matrices, see § 12).

The list notation can in quite a few cases be transformed into a tree of the kind which is familiar from transformational grammar. For example, (3) corresponds to the following tree:

(4)



This parallelism does not hold as a general rule, however (cf. § 12 below). In the cases where the matrix contains several arguments, they must be distinguished in some way. Often, the arguments are necessarily different as to the categories they belong to, so any extra indication is redundant. In other cases, it would be possible to let the order of the arguments distinguish them - as is done in predicate logic - but we have instead chosen to keep them apart by so-called *case indices* (perhaps a slightly misleading name, since they do not always correspond to cases in the usual sense). Thus, in the verb phrase *visa Kalle Göteborg* 'show G. to K.', we must distinguish the direct from the indirect object. This is done in the following way:

(5) PRED = VB0 (IO: NP1, DO: NP2)
NP1 = PN0
PN10 = Kalle

The arguments are subdivided into *arguments proper* and *modifiers*. The latter group includes attributes and adverbials.[FN] Whereas a given matrix with a given lexeme as head can only be combined with certain kinds of arguments proper, modifiers may be combined with any lexemes. We write modifiers inside square brackets. For example, the verb phrase *äta sakta* 'eat slowly' would have the following structure:

(6) PRED = VB0 [ADV1]
VB0 = Äta
ADV1 = Sakta

4 SPELLING-OUT

The categorial structures represent abstract plans or programs for speech acts. By themselves, they do say nothing about the form or content of speech acts. The content is obtained by applying *rules of interpretation* to the categorial structures and the form is determined by what we call *spelling-out rules*. Describing the form of a speech act means describing it in terms of 'external behavior', say, of a sequence of muscular movements. Like the categorial structure, such a description can be seen as a 'program' for the speech act, but a program on another level.

We can thus think of it as a sequence of commands to the speech apparatus. Since we do not at present have any possibility of solving all the problems that occur on this level of description, it is more convenient to think in terms of written language. We may then specify the output of the spelling-out rules in ordinary orthography and imagine that this output represents sequences of instructions (approximately 'graphemes') to a printer plotter or a human typist.

What do the spelling-out rules accomplish in more concrete terms? Very roughly, the spelling-out procedure means that one for every lexeme in the categorial structure finds a sequence of graphemes which 'expresses' this lexeme and then 'spells out' in a certain order the grapheme sequences obtained. In traditional terms, what one must do is to determine what *word forms* the sentence or utterance is to consist of and what the *word order* is. As everyone who has done work in syntax knows, it is no trivial task to construct a set of rules that accomplishes this job for a reasonably large set of utterances in a language. But we also want the spelling-out principles to be such that the description can be extended to languages other than Swedish and hopefully also be such that they can express certain generalizations about universal syntax.

The categorial structure does not always determine the spelling-out of the expression by itself. In fact, it is necessary to take various factors of the speech situation into account (e.g. the identity of the addressee). The spelling-out rules may refer to such situational factors, which we will call *pragmatic information* (PI). In this respect, our syntax is not autonomous.

In principle, it is possible to have spelling-out rules that apply to a certain type of matrices or a certain category of lexemes or even to a single lexeme. However, our aim is to account for as much as possible by *general spelling-out principles* or *metarules*. Only in cases when these spelling-out principles need to be complemented, or some category or lexeme is an exception to them, do we need to give particular

information in the grammar or the lexicon.
The spelling-out principles are specified below in the form of flow diagrams.

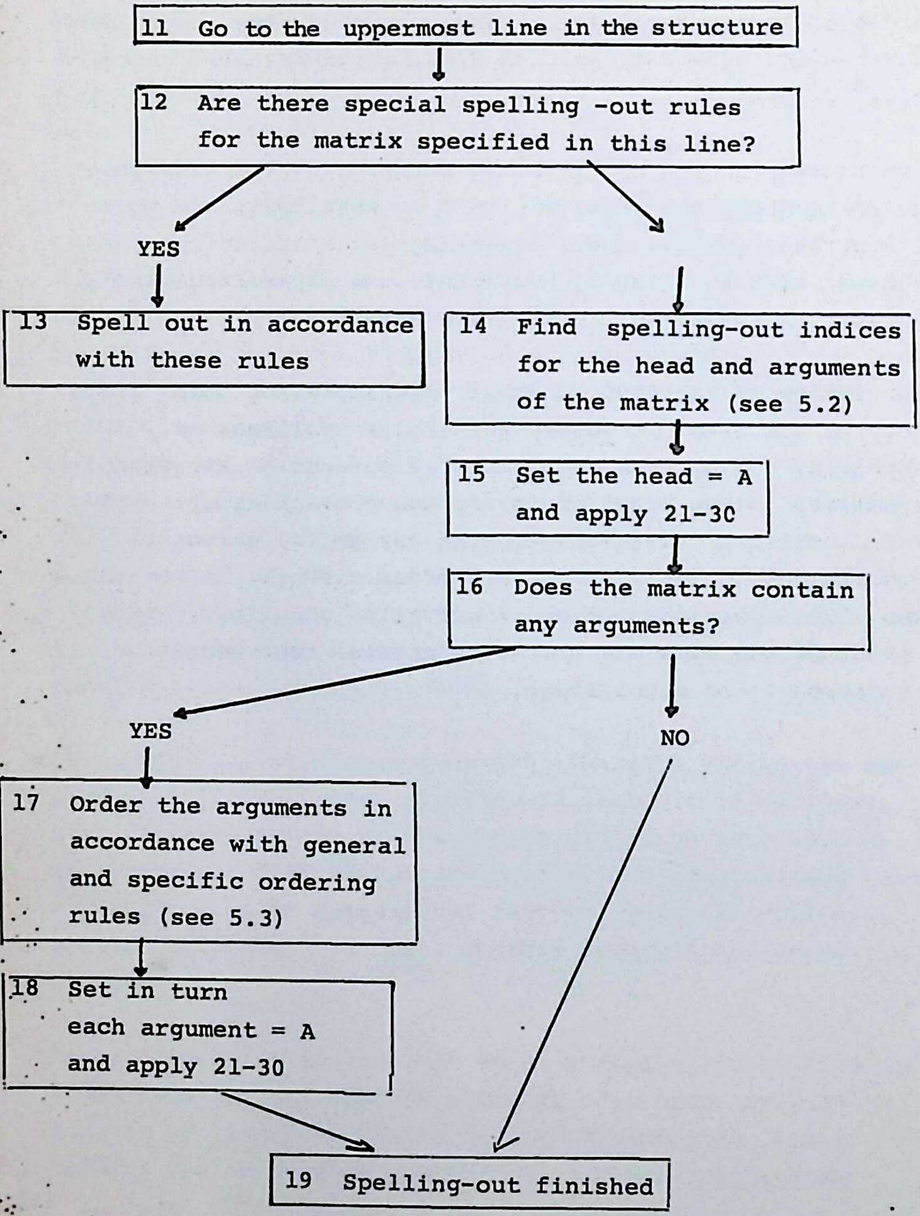
In addition to the general spelling-out principles, there are also metarules of a more special kind, which are also given below.

We try to distinguish consistently entities in the categorial structure and the sequence of graphemes that spell out these entities. Thus we talk about *heads* and *arguments* on the categorial structure level, but about *head expressions* and *argument expressions* on the spelling-out level.

In the following section, a number of examples of categorial structures are given, together with their spellings-out. The spelling-out of each entity in the categorial structure is specified to the right of it. By the convention of writing the head before the arguments in the categorial structure, we usually obtain the correct word order directly in the column to the right. This convention is actually 'cheating', since the order of the elements in the categorial representation is not supposed to be significant.

5 GENERAL SPELLING-OUT PRINCIPLES

5.1 Introductory rules


11 Go to the uppermost line in the structure
12 Are there special spelling -out rules for the matrix specified in this line?
YES
13 Spell out in accordance with these rules
14 Find spelling-out indices for the head and arguments of the matrix (see 5.2)
15 Set the head = A and apply 21-30
16 Does the matrix contain any arguments?
YES
NO
17 Order the arguments in accordance with general and specific ordering rules (see 5.3)
18 Set in turn each argument = A and apply 21-30
19 Spelling-out finished

5.2 Comments on the introductory rules.

The numbers refer to the boxes in the flow diagrams.

11: The spelling-out always goes from the top downwards: one begins by considering the first line in the structure.

12: At each step in the spelling-out, one checks whether there are any special spelling-out rules which are to be applied or if the general principles apply.

14: Each entity to be spelled out (except for the one specified in the first line) has a so-called *spelling-out index* which indicates the 'program' which should be used to spell it out. The spelling-out indices are obtained by applying the rules in 5.4 and are of two kinds:
morphological indices which choose a certain form of a lexeme (e.g. a case),
syntactic indices, which may, for instance, entail the insertion of a certain particle. (For each syntactic spelling-out index, there is a special rule in the grammar which indicates the spelling-out program in question).

15: This box means that, in normal cases, the head is spelled out before the arguments.

17: The general ordering rules for arguments are given in 5.3.

21: See the comment to 14.

22: If the entity is unspecified, it is not spelled-out at all and one goes on to next item.

24: Inherent morphological properties (e.g. gender) must, above all, be taken into account in the case of noun phrases.

26: Each line specifies either a matrix or a lexeme.

29: Here, one returns and applies the rules once more, but this time to a lower level in the categorial structure. So the process continues until the whole structure has been worked out.

5.3 Argument ordering rules.

These rules are applied when a matrix contains several arguments. If there are several orders that fulfill the conditions, all are possible.

(1) A precedes B, if A belongs to a higher matrix than B in the categorial structure.

(2) A precedes B, if A controls B.

(3) A precedes B, if A has a higher rank than B.

(4) If A is an enclitic word, A may precede B even if B should precede A according to to (1-3).

Comments:

(1) This rule becomes relevant in the cases when the promotion rules (§7) have been applied.

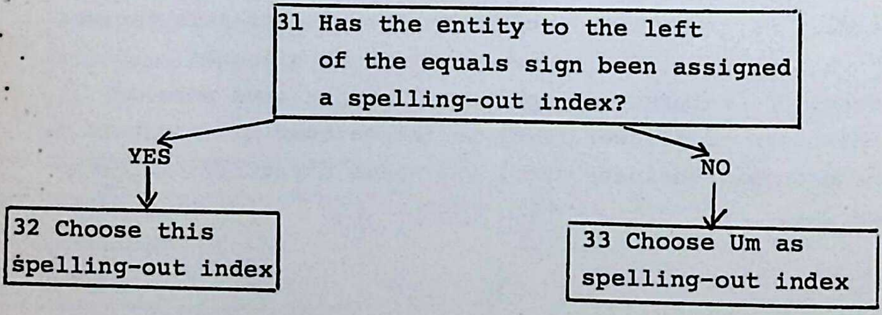
(2) For the control relation, see § 6.

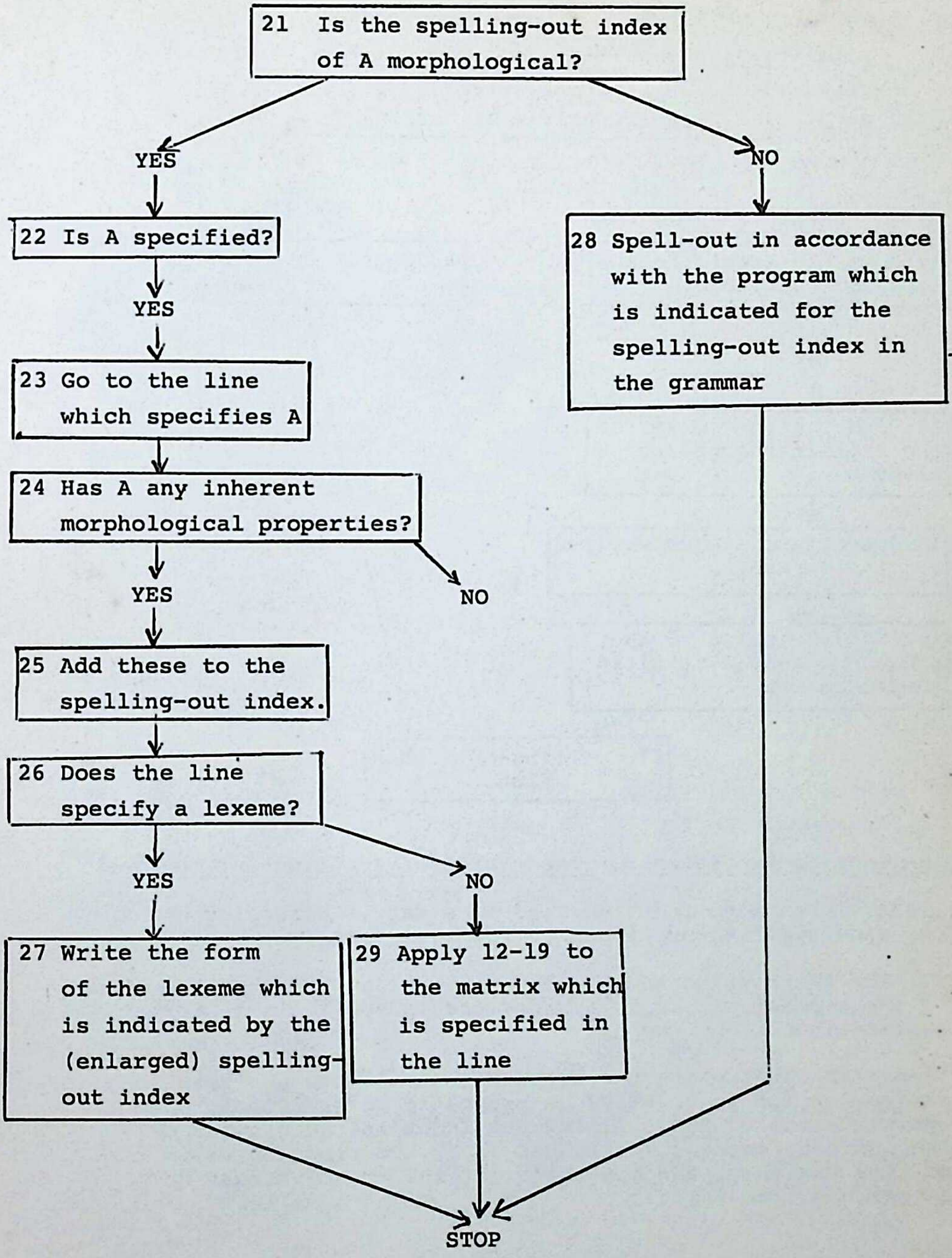
(3) The grammar may specify that a certain type of argument has higher rank than another (see e.g. §10).

(4) Enclitic words are for instance the negation words *inte*, *icke* and *ej* and the reflexive pronoun *sig*.

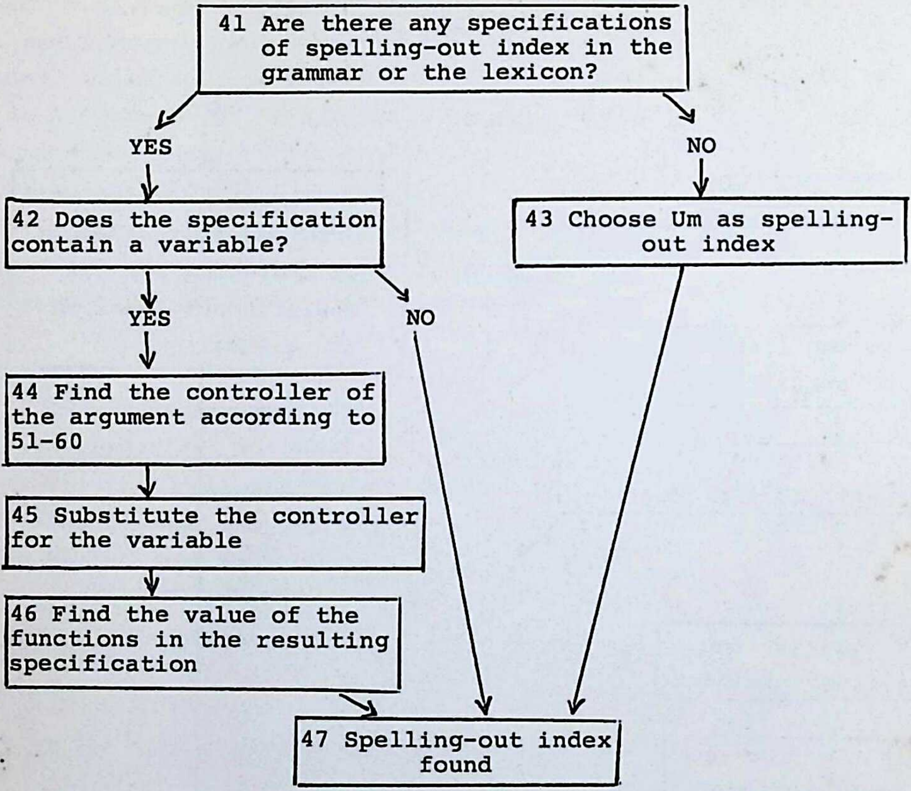
5.4 Rules for spelling-out indices

A. Head expressions


31 Has the entity to the left of the equals sign been assigned a spelling-out index?
YES
NO
32 Choose this spelling-out index
33 Choose Um as spelling-out index


21 Is the spelling-out index of A morphological?
YES
NO
22 Is A specified?
YES
23 Go to the line which specifies A
24 Has A any inherent morphological properties?
YES
NO
25 Add these to the spelling-out index.
26 Does the line specify a lexeme?
YES
NO
27 Write the form of the lexeme which is indicated by the (enlarged) spelling-out index
29 Apply 12-19 to the matrix which is specified in the line
28 Spell-out in accordance with the program which is indicated for the spelling-out index in the grammar
STOP

B. Argument expressions


41 Are there any specifications of spelling-out index in the grammar or the lexicon?
YES
NO
42 Does the specification contain a variable?
43 Choose Um as spelling-out index
YES
NO
44 Find the controller of the argument according to 51-60
45 Substitute the controller for the variable
46 Find the value of the functions in the resulting specification
47 Spelling-out index found

5.5 Comments on the rules for the choice of spelling-out indices.

31-32: This means that the head of a matrix generally obtains the same spelling-out index as the whole matrix.

33: The instruction in this box will be applied when the head of the topmost matrix in a structure is spelled out. For an explanation of Um, see 5.6.

42-44: In cases where the argument agrees with another expression (or is governed by pragmatic information), the specification of the spelling-out index in the grammar or the lexicon contains a variable (X,Y). To find the value of this variable, the controller of the argument must be determined (see §6).

5.6 Special spelling-out index specifications.

Tp ('transparent'):Choose the spelling-out index of the entity to the left of the equals sign.

(This is the same principle as holds for the spelling-out of heads (box 32). It means that the spelling-out indices are 'distributed downwards' through the tree).

Um ('unmarked'): Choose the unmarked spelling-out index for the category in question.

(Each matrix is supposed to have an unmarked spelling-out index, which is associated with an unmarked morphological form. For noun phrases, this index is Nom ('nominative'), for predicates Imp ('imperative').

6 THE CONTROL RELATION

The control relation is of importance primarily for agreement, but also for phenomena such as the use of reflexive pronouns. If X controls Y (X is the controller of Y), Y will normally agree with X. Reflexive pronouns can usually be used only if they are constituents of a phrase which is controlled by the antecedent of the pronoun.

The control relation is here assumed to be secondary in the sense that it can be derived from the categorial structure (in other words, it need not be indicated separately). The control rules that are given in 6.2 are general principles which may have exceptions.

The arguments are generally of two types: *controllable* and *uncontrollable* (earlier terminology: 'dependent' and 'independent'). Only controllable arguments have controllers (in other words, the control rules below apply only to them).

There are two kinds of controllers, *syntactic* controllers, which are entities in the categorial structure, and *semantic* controllers, which are entities in the world. (The latter applies in particular to imperatives, where the controller is the addressee).

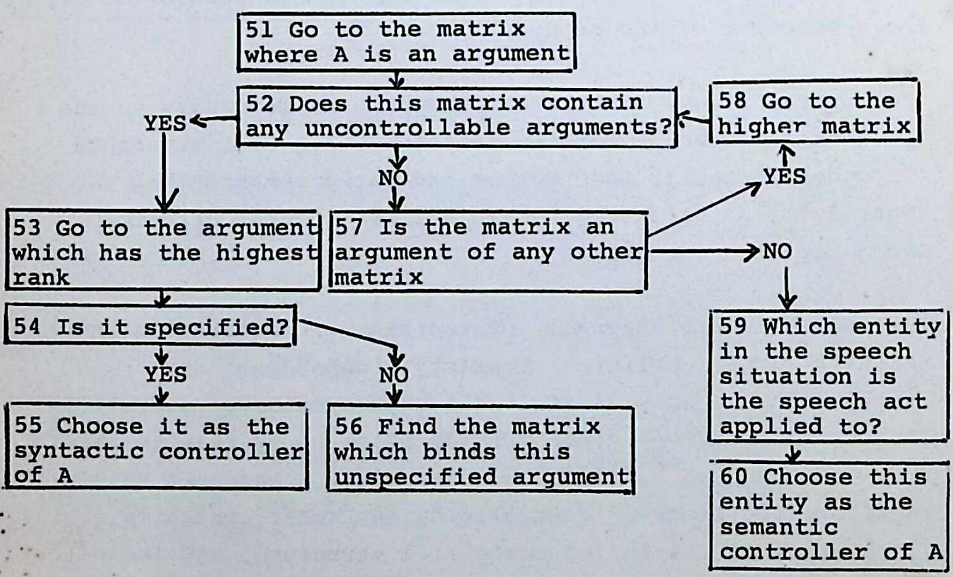
As the control rules are formulated, the concept 'controller of' will generally correspond to 'deep subject of' or 'NP which triggers Equi-NP-deletion' in transformational grammar. Usually, the following rule of thumb will hold:
The controller of X is the noun phrase which is closest to X in the categorial structure.

Examples of control relations:

In the sentence Pelle verkar vara snäll 'P. seems to be kind', snäll 'kind' is controlled by Pelle.
In the sentence Pelle gjorde Kalle arg 'P. made K. angry', arg 'angry' is controlled by Kalle.

6.2 Control rules.

Given: a controllable argument A
Task: find the controller of A


51 Go to the matrix where A is an argument
52 Does this matrix contain any uncontrollable arguments?
58 Go to the higher matrix
YES
NO
YES
53 Go to the argument which has the highest rank
57 Is the matrix an argument of any other matrix
NO
54 Is it specified?
YES
NO
59 Which entity in the speech situation is the speech act applied to?
55 Choose it as the syntactic controller of A
56 Find the matrix which binds this unspecified argument
60 Choose this entity as the semantic controller of A

7 PROMOTION RULES

To account for a number of troublesome problems in the description of Swedish word order (e.g. subject-verb inversion), we have introduced a mechanism called *promotion*, which is to have approximately the same function as the movement rules of transformational grammar.

In several cases, a constituent appears to be moved to the initial position in a matrix. Since, according to our rules, this place is reserved for the head expression, we interpret these facts by saying that what happens is that a constituent is secondarily assigned head expression status. This formulation is perhaps not as ad hoc as it may seem. If the hypothesis is correct, the mechanism we postulate may help to formulate principles that amount to 'constraints on possible movement transformations' and consequently may also be helpful in word order typology. For instance, there are so far unexplained correlations between the existence of 'movement rules' in languages and the order of head and argument expressions in the same languages. (Thus, only languages with VO order have rules that move questioned elements in interrogative sentences) (Greenberg 1963).

Cases where promotions are to take place are indicated separately in the spelling-out rules. There are two 'promotion programs', which we call PROM(X,Y) and PROMHEAD(X), where X and Y have to be specified for each particular case. These programs look like this:

```
PROM (X,Y)
(1)  Spell out Y as usual.
(2)  Spell out the matrix once more according to 15-19 but let
(a)  the head expression be the spelling-out of X according
     to (1) and
(b)  the argument expression be Y except that X is deleted.
```

PROMHEAD (X)

(1) Spell out the matrix according to the ordinary rules.

(2) Apply 15-19 once more but choose now as head expression the head expression of X according to (1) and as argument expressions the spelling-out of the ordinary arguments of the matrix except X and the argument expressions of X according to (1).

For an example of promotion operations at work, see § 10 below.

8 LEXICAL CATEGORIES

In the 'fragment' treated in this paper, we use lexemes belonging to the following lexical categories:

Category label	Number of places	Functions as head of	Examples
VB (verb)	zero-many	PRED (predicate)	Springa 'run' Sova 'sleep' Cykla 'cycle' Slå 'Hit' Kyssa 'kiss'
CN (common noun)	zero-many	CNP (common noun phrase)	Häst 'horse', Hus 'House' Far 'father'
PN (proper name)	zero	NP (noun phrase)	Kalle, Göteborg
ADJ (Adjective)	zero-many	ADJP (Adjective phrase)	Stor 'big', Röd 'red', Lik 'like'
ADV (Adverb)	zero	ADVP (Adverbial phrase)	Inte 'not'
PREP (preposition)	one	PREPP (prepositional phrase)	På 'on, at', I 'in'

9 THE STRUCTURE OF THE SENTENCE

A simple declarative sentence, e.g. Kalle cyklar 'K. cycles/ is cycling', is supposed to have a categorial structure where the first line looks like this:
(7) S = NEX(NP1, PRED2)
NEX thus takes two arguments, a noun phrase and a predicate. The predicate is controllable and, consequently, its controller is the noun phrase.

The following spelling-out rules hold:

(8) Spelling-out rules for NEX(NPa, PREDb):
Spelling-out index for PREDb: Fin(RT)
In main clauses where some expression has already been spelled out and in yes-no questions, PROMHEAD(PREDb) applies.

Explanations:

RT refers to the *reference time*, approximately the point or period in time which the statement concerns. Depending on whether RT precedes the utterance time (UT) or not, past or present tense is chosen according to the following rule:

(9) Tense rule.
$\text{Fin}(t_1) = \text{Pret if } t_1 < \text{UT}$
$\qquad\qquad\quad \text{Pres otherwise}$

For an explanation of PROMHEAD, see § 7. (8) entails that the head expression of the verb phrase (i.e. the finite verb) becomes head expression of the NEX matrix if something other than the subject is in initial position (verb-second constraint).

There is no indication of a spelling-out index for the subject, which means that one chooses the unmarked form (nominative).

The topmost matrix of a sentence may also be fore instance SAI (sentence adverb introduction) which takes and ADVP and an S as arguments.

In the sentence *Troligen cyklar Kalle* 'Probably K. is cycling', the adverbial phrase is *troligen* 'probably' and the argument sentence *cyklar Kalle* '(lit) cyles Kalle'. For SAI, there are no particular spelling-out rules, i.e. the spelling-out is completely determined by the general principles, which means, among other things, that the order of the arguments is free (we could also have *Kalle cyklar troligen*).

10 THE STRUCTURE OF THE PREDICATE

The simplest case is when the predicate consists of a verb with a number of arguments, which may be either noun phrases or subordinate predicates. We may then get structures of the following types:

(10)(a)	PRED = VBO	intransitive verbs
(b)	PRED = VBO (NP1)	transitive verbs with one object
(c)	PRED = VBO (IO:NP1, DO:NP2)	verbs with two objects
(d)	PRED = VBO (INF:PRED1)	verbs with infinitive complement
(e)	PRED = VBO (DO:NP1,INF:PRED2)	verbs with object-with-infinitive construction

For each case index (type of argument), we need information about (a) spelling out index, (b) controllability, (c) rank in relation to the other types.

CASE INDEX	SPELLING-OUT INDEX	CONTROLLABILITY	HIGHER IN RANK THAN
IO (indirect object)	Obl	-	all others
DO (direct object)	Obl	-	all others except IO
INF (infinitive)	Inf^{m}	+	
AINF (*att*-infinitive)	Att	+	
PV (predicative)	Agree (X)	+	

Obl = oblique case (relevant for pronouns only)
Inf^m = infinitive form of the verb
Att = infinitive preceded by *att* 'to'
Agree(X) means that the predicative agrees with its controller (the subject or object respectively).

In certain cases, the spelling-out index has to be indicated in the lexicon; this is true in particular for various types of prepositional objects (e.g. *lita på* 'rely on'). The order of the arguments is determined by the general ordering rules (§ 5.3).

In addition to arguments proper, a predicate may also contain modifiers, which are usually prepositional phrases or adverbs. We also postulate another source for adverbs, viz. by a matrix called PAI (predicate adverb introduction), which functions parallelly to SAI (see above) and which takes an adverb and a predicate as arguments. The adverbs which are introduced in this way are those which obligatorily precede the finite verb in subordinate clauses (negation, and so-called sentence adverbs). For them, the following spelling-out rule holds:

(11) *Spelling out rule for PAI(ADVa, PREDb)*:
In main clauses: PROMHEAD (PREDb)
In subordinate clauses: ADVa precedes PREDb
Spelling-out index for PREDb: Tp

This rule means that the adverb comes first in subordinate clauses but after the finite verb in main clauses and that the verb is in the same form as it would be if it were the head of the predicate.

Below are some examples of categorial structures with their spellings-out:

(12) *Anders cyklar* 'Anders cycles/is cycling'
S = NEX(NP1, PRED2)
NP1 = PN0
PN10 = Anders ——— Nom(Anders) ———→ *Anders*
PRED2 = VB0
VB20 = Cykla ——— Pres(Cykla) ———→ *cyklar*
(PI: RT=UT)

(13) Anders cyklar inte 'Anders does not cycle/is not cycling'
S = NEX(NP1, PRED2)
NP1 = PN0
PN10 = Anders ———— Nom(Anders) ——→ Anders
PRED2 = PAI(ADV1, PRED2) - - - - - - - - - PROMHEAD(PRED 22)
ADV21 = Inte ———— inte
PRED22 = Cykla —— Pres(Cykla) → cyklar } ⇒ cyklar inte

(PI: RT=UT)

(14) Kalle såg Pelle kyssa Lisa 'Kalle saw Pelle kiss Lisa'
S = NEX(NP1, PRED2)
NP1 = PN10
PN10 = Kalle ———— Nom(Kalle) ——→ Kalle
PRED2 = VB0(DO: NP1, INF: PRED2)
VB20 = Se ———— Pret(Se) ——→ såg
NP21 = PN210
PN210 = Pelle ———— Objf(Pelle) ——→ Pelle
PRED22 = VB0(NP1)
VB220 = Kyssa ———— Inf^m(Kyssa) ———— kyssa
NP221 = PN0
PN2210 = Lisa ———— Objf(Lisa) ——→ Lisa

(PI: RT<UT)

11 SENTENCES WITH FORMAL SUBJECTS

The so-called formal subject det which occurs in sentences such as Det kommer en man 'There comes a man' and also the impersonal det in sentences such as Det regnar 'It rains/ is raining' are assumed to be derived from an element in the categorial structure called FSubj. The semantic function of FSubj is to mark that the statement does not concern (does not have as topic) any particular element in the universe of discourse but instead concerns the global situation.

Only certain types of predicates can be combined with FSubj. They include on the one hand verbs like regna 'rain' and on the other derived predicates formed with the help of the matrix

As an example, we choose the sentence Göteborg gillar Pelle inte 'Göteborg Pelle does not like', where Göteborg is the topicalized object. We postulate a binding matrix TOP which takes a sentence as argument. The bound argument - in this case the topicalized element - is indicated inside curly brackets ({}) and the categorial structure will thus look like this:

(17) Göteborg gillar Pelle inte 'Göteborg Pelle does not like'
S = TOP {NP1221} (S1)
S1 = NEX (NP1, PRED2)
NP11 = PN0
PN110 = Pelle
PRED12 = PAI(ADV1, PRED2)
ADV121 = Inte
PRED122 = VB0(NP1)
VB1220 = Gilla
NP1221 = PN0
PN0 = Göteborg
(PI : RT=UT)

(18) Spelling-out rule for TOP{Xa}(Sb): PROM(Xa, Sb)
This rule means that the topicalized element is spelled-out first in the sentence.

As an example of a construction where the bound element is unspecified, we choose the sentence John är lätt att tillfredställa 'John is easy to satisfy'. Here, the adjective lätt 'easy' is the head of a matrix which binds a noun phrase in a predicate. The categorial structure will then look like this:

(19) John är lätt att tillfredställa 'John is easy to satisfy'
S = NEX(NP1, PRED2)
NP1 = PN0
PN10 = John ——— Nom(John) ———→ John
PRED2 = VB0(PV: ADJP1)
VB20 = Vara ——— Pres(Vara) ———→ är
ADJP21 = ADJ0 {NP211} (AINF: PRED1)
ADJ210 = Lätt ———→ lätt
PRED211 = VB0(NP1)
VB0 = Tillfredställa ———→ att tillfredställa
(PI : RT=UT)

SIT. SIT is a two-place matrix which takes a noun phrase and a predicate as arguments and gives a predicate as its output. A sentence such as *Det kommer en man* 'There comes a man' has the following categroial structure and spelling-out:

(15) *Det kommer en man* 'There comes a man'
S = NEX(NP1, PRED2)
NP1 = FSubj ——→ *det*
PRED2 = SIT(NP1, PRED2)------------------PROMHEAD(PRED2)
NP21 = QUANT0(CNP1)
QUANT210 = En ——→ *en*
CNP211 = CN0
CNP2210= Man —— Nom(Man) ——→ *man*
PRED22 = VB220
VB220 = Komma —— Pres(Komma) ——→ *kommer*
} → *kommer* *en* *man*
(PI: RT=UT)

For SIT, the following spelling-out rule holds:
(16) *Spelling-out rule for SIT(NPa, PREDb)*: PROMHEAD(PREDb):
Spelling-out index for PRED: Tp

12 BINDING MATRICES

A binding matrix differs from other matrices in that a certain element (a 'constituent in one of its arguments is bound, that is, it is singled out and given a special function and position in the phrase. Examples of binding matrices are those which give rise to *wh*-questions, topicalizations, relative clauses, cleft sentences, and other constructions that are accounted for with the help of movement or deletion transformations in transformational grammar.

13 PASSIVE SENTENCES

Passive sentences are constructed with the binding matrix PASS, which binds an unspecified element (ordinarily an object) in a predicate. The sentence Pelle sågs kyssa Lisa 'Pelle was seen kissing Lisa' thus has the following categorial structure:

(20) Pelle sågs kyssa Lisa 'Pelle was seen kissing Lisa
S = NEX(NP1, PRED2)
NP1 = PN0
PN10 = Pelle———————— Nom(Pelle)————→ Pelle
PRED2 = PASS {NP211}(PRED 1)
PRED21 = VB0(DO: NP1, INF: PRED2)
VB210 = Se———————— Pret(PASS^m(Se))————→ sågs
PRED212 = VB0(NP1)
VB2120 = Kyssa———————— Inf(Kyssa)————→ kyssa
NP2121 = PN0
PN21210 = Lisa———————— Objf(Lisa)————→ Lisa

(PI : RT<UT)

(21) Spelling out rule for PASS{NPa} (PREDb):
Spell out as PREDb but add Pass to the morphological index of VBc, where VBc is the highest verb in PREDb.
The sentences obtained in this way are agentless passives. Passives with agents are formed by adding the agent NP as an extra argument to the PASS matrix. So, Pelle slogs av Kalle 'Pelle was hit by Kalle' has the following categorial structure:

(22) Pelle slogs av Kalle 'Pelle was hit by Kalle'
S = NEX(NP1, PRED2)
NP1 = PN10
PN10 = Pelle
PRED2 = PASS {NP211} (PRED1, AG: NP2)
PRED21 = VB0(NP1)
VB210 = Slå
NP22 = PN0
PN220 = Kalle

(PI : RT<UT)

14 INTERROGATIVE SENTENCES

We restrict ourselves here to yes-no questions. They are supposed to contain a matrix Q which takes a declarative sentence as argument. The sentence Cyklar Anders? 'Does Anders cycle?' will then have the following categorial structure and spelling-out:

(23) Cyklar Anders? 'Does Anders cycle?'

```
QS     = Q(S1)-------------------------PROMHEAD(PRED12)
S1     = NEX(NP1, PRED2)
NP11   = PN0
PN110  = Anders---------Nom(Anders)--- Anders ⎫       cyklar
PRED12 = VB0                                  ⎬ ⇛
VB120  = Cykla--------- Pres(Cykla)--- cyklar ⎭       Anders
   (PI : RT=UT)
```

15 AN ALTERNATIVE TREATMENT OF MORPHOLOGICAL PROPERTIES

Perhaps most recent work in the theory of grammar, in particular within generative transformational grammar, has been guided by a principle which has not always been made explicit. This principle can be formulated as follows:
The structural description of a linguistic expression should contain only information that is not predictable from anything else in the description. Given that two phenomena depend on each other in some way, an adherent of the principle will try to eliminate one of them from the more abstract levels of description, leaving its work to a rule which specifies how a certain abstract structure is actually realized. For instance, there has been a tendency in transformational grammar to let as much work as possible be done by the transformations, keeping the deep structure as clean as possible. Similarly in operational grammar, we have tried to let the spelling-out rules take care of as much work as possible. However, given the observation that A always

cooccurs with B, we may choose between the following two possibilities:

(a) Postulate only A as a primary entity and regard B as a derived one (or the other way round),

(b) Postulate both as primary entities and formulate a rule which says that one always occurs with the other.

It is not always the case that (a) - the alternative discussed in the preceding paragraph - is preferable. One case in point is the problem of how morphological properties of expressions should be treated. In the treatment of Swedish syntax presented earlier in this paper, it was assumed that expressions were assigned morphological indices by the spelling-out rules, depending on what their categorial structures looked like. Another alternative along the lines of (b) is possible and, it now seems to me, preferable. One could assume that, in addition to its categorial structure, any expression is also equipped from the start with a morphological index. (Alternatively, one may consider the morphological index to be part of the categorial structure). Rules will then have to be formulated which state cooccurrence restrictions between morphological indices and categorial structures. There are several advantages of such a model:

(a) As is made clear in Källström's paper in this volume, agreement in Swedish noun phrases seems to work both 'from the bottom up' and 'from the top down'. In Källström's treatment, the first case is taken care of by 'assignment conditions', the second by the spelling-out rules proper. If each node in the categorial structure is assumed to have its own morphological index (part of which is provided by inherent morphological properties of lexemes), the general rule will simply be that all nodes in a noun phrase must have the same morphological index. Thus, there will be no need for two kinds of rules.

(b) In some cases - for instance, in dealing with pronouns - it is preferable to let the choice of the morphological index be free. This possibility is more easily attainable in the new approach.

(c) We may get away from the need to specify pragmatic information in the categorial structure. In the formulation above, tenses were assumed to be determined by the reference time of the utterance, specified directly after the categorial structure (see for instance Fig. 23). We may now assume that tenses are determined by the morphological index of the whole sentence, and let the relation between tenses and the reference time of the sentence be taken care of by a general tense rule (which will be a slight modification of rule (9) of Part I).

(d) Some economy may be gained by letting the morphological index consist only of marked categories, and by representing unmarked categories as Ø. This convention will allow us to dispense with the rules for choosing unmarked indices.

(f) It is often unclear where to draw the line between the syntactic structure of an utterance and what should be regarded as different ways of using one and the same syntactic structure. This is probably a pseudo-problem, which arises when trying to treat the formal properties of utterances as independent of the other properties. The problem comes up for example with imperative sentences. In earlier reports, we postulated a matrix IMP, which took a sentence or (in other versions) a predicate as argument. But imperative sentences are the only ones where a predicate can be used alone (without the construction being elliptic). The following solution is then possible. A certain structure may be used in two ways: on the one hand, dependently, i.e. as part of another categorial structure, on the other, independently, i.e. as a speech act of its own. For each type of matrix, we list its possible independent uses and the restrictions that exist for choosing the morphological index of the matrix. For example, a predicate can be used with imperative function (in which case it has imperative form) and a noun phrase can be used with vocative function (in which case it is in the nominative). Generally, when a matrix has only one independent use, it will tend to be unmarked morphologically.

This solution is not without its disadvantages, however. The use of morphological marking is often functionally equivalent to other syntactic processes. Thus, the same category may be expressed by affixes on verbs or by auxiliary verbs. The treatment of morphological categories outlined here seems to make it harder to derive such functionally equivalent structures from the same source. This shortcoming may be an indication that the level of categorial structure as defined here is not suitable for expressing such generalizations.

In Dahl 1974, it was said that the operational approach to grammar was consonant with Item-and-Process morphology. In Källström's contribution to this volume, something which looks more like Word-and-Paradigm morphology is proposed. This trend will be further accentuated if the solution outlined above is accepted. It should be noted, however, that the morphological spelling-out rules will probably still largely be of the 'process' type.

FOOTNOTE

In Montague grammar, an expression which modifies expressions of category C are treated as functions from category C to category C. We have followed this treatment of modifying constructions in earlier versions. We have never felt particularly happy about it, however. There are several problems, e.g.:

(a) Treating the modifier as a functor head and the modified expression as an argument of the modifier implies that such constructions should follow the general word order rules for head and argument expressions. However, very often they do not: in many languages, constructions like adj-noun tend to be ordered in an opposite way to that which we would expect if adjectives are functors.

(b) According to this hypothesis, noun phrases and prepositional phrases embedded in verb phrases or other noun phrases derive from two radically different sources - either they are arguments to the head of the phrase or they are operations taking the rest of the verb phrase or noun phrase as their argument. In actual practice, it turns out to be very hard to find any good criteria for distinguishing these two types. On the other hand, verb phrase adverbials are categorially not distinct from verbs taking taking infinitive complements - which we should expect them to be considering their rather different behavior.

Such considerations led us to choose the treatment of modifiers presented in this paper.

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GAMES AND MODELS

ÖSTEN DAHL

1 INTRODUCTION

1.1 Statement of aim. This paper is devoted to two problems, which I shall refer to as Wittgenstein's Semantic Problem and Wittgenstein's Pragmatic Problem,[1] respectively. I think these problems are among the most fundamental in the study of language in the sense that when we have answered them there will probably not be much left to say. Consequently, it would be preposterous for me to claim that I have found the solution to them. Rather, what follows are some scattered reflections and attempts to sort out a few things for myself.

1.2 Wittgenstein's Semantic Problem can be formulated in a number of ways. The simplest is as follows:
(1) What is the relation between the structure of language and the structure of the world?

More specifically, we may ask the following question:
(2) What happens to us when we hear a statement, understand it and accept its truth? Does what happens in our brains have any relation to, on the one hand, the utterance we hear, and on the other, the things in the world that the utterance concerns?

We can obtain information about the world in many ways. If we want to go somewhere, we can look at a map or obtain verbal instructions from someone who has been there. The question is now: What is the difference between the map and the words that are used to show us the way? The simplest answer is provided by the *naive picture theory*. It says: there is no difference. We learn something about the world from the map because the structure of the map is the same as the structure of the part of the world it represents. Likewise, declarative sentences have the same structure as the reality they talk about.

Few people would defend the naive picture theory in its pure form. To show the consequences such a theory has, let us take an example from Sloman 1975. A phrase such as the city 53 miles from Brighton, he says, contains the symbol Brighton as a part, but the thing denoted - London - does not contain Brighton as a part. London has a complex structure of its own, but it has no relation whatsoever to the structure of the phrase.

Still, we cannot just be content with stating that a map and a linguistic discourse are different in nature; we must also try to answer the question: How do they differ? The importance of this question is brought into focus by the following fact, which may also be the first step to the solution of the problem: Even if maps and linguistic descriptions of reality are different, part of most people's cognitive ability is the ability to 'translate' from one to the other, i.e. if I see a map of the relevant area, I can also explain in words how to go from one point to another.

We may also consider the intuitive and very common view of what happens when we understand a statement: it evokes a mental picture inside us of a situation.

This view suggests the *constructional hypothesis*:[2]
(3) A declarative discourse - i.e. a discourse consisting of statements - is an instruction to construct a picture or model of something in the world.
As it stands, (3) is more a metaphor that may suggest a possible approach than a concrete hypothesis. Part of what I want to do in what follows is to put some substance into (3). It may be useful here to mention some people who have previously made statements which are similar or equivalent to (3).

In Hintikka 1973, the influence of which will be evident throughout this paper, the following statement is made in connection with a discussion of the 'picture theory of language' (p.47): 'Sentences do not contain pictures somehow hidden inside them. Rather, they are recipes for constructing alternative pictures of the world'. Hintikka's book was written from a logician's point of view. People working within quite a different (or seemingly different) area, namely perceptual psychology, have put forward theories of perception and memory which suggest that we perceive an object by building up an isomorphic mental representation of it, and that what is stored in our memories are plans for building up such representations (see for instance Neisser 1967 and Bransford et al. 1972). Öhman 1975 hypothesizes that

'In perception in general, the plan actively detected or passively found in the pattern of sense impressions generated by the perceptual operations can be interpreted as BEING THE CONSTRUCTIONAL PLAN OF THE OBJECT OF PERCEPTION ITSELF'. Further, he extends this idea to the treatment of how linguistic expressions are interpreted, claiming that 'the understanding of the sentence is nothing but the determination of the perceptual plan (structured meaning) codified by the phonetic signal'.

Similar ideas have also, within the field known as 'artificial intelligence, been employed for constructing programs which simulate human behavior. Some references are Winograd 1972, Isard & Longuet-Higgins 1973, Raphael 1968, Becker 1973, Schank & Nash-Webber 1975.

With a metaphor which is very similar to the one used in Dahl 1975 and sect. 2.1 below, Fillmore 1976 suggests 'that we should think of the representation of the meaning of a word or text as a set of instructions addressed to a cartoonist or a film-maker, these instructions imposing constraints on how a comic strip, film strip or movie can be made which will display an image or situation representing what the word or text can 'mean'.

1.3 The 'analog/propositional controversy'. Before going further, we should mention the so-called 'analog/propositional controversy'. This controversy has concerned the nature of mental representations of perceptual information, and a slightly simplified account of it would be to say that the question is whether we represent information about the world as maps or as statements. My opinion in this matter is as follows: the main problem is not whether representations are of one type or another. The fact that we are able to cope with both types of description of reality directs us instead to ask some of the questions we asked above, namely: What are the fundamental properties of the different kinds of representations and how do they differ? How is it possible to go from one to another? (This direction of enquiry also seems to be compatible with the views recently expressed by several people involved in the discussion, e.g. Palmer 1975, Pylyshyn 1975, Sloman 1975).

1.4 Wittgenstein's Pragmatic Problem can be most simply stated as follows:

(1) What is the relation between what we say and what we do?

This question can be seen as a natural continuation of Wittgenstein's Semantic Problem. We soon find that telling each other things about the world is only one of the things we do when we talk: we also use language to influence other people's behavior, to regulate our social relations, to perform various ceremonies etc.. So, we may ask: What is common to all these activities? Wittgenstein's answer was that they are all *language games* - whenever we are talking, we are involved in one of a huge set of games the rules of which constitute the rules of our language.

Here again, we are dealing with a rather metaphorical concept, which cannot do more than suggest the direction in which we should develop the theory. Wittgenstein's concept of a language game has been a source of inspiration for many people (Some references are Stenius 1960,1967, Ballmer 1972, Wunderlich 1972, Hintikka 1973, Severinson-Eklundh 1976, Carlson 1976).

What particularly interests me here is the possibility of using the concept for embedding the treatment of the 'descriptive content' of declarative sentences into a more comprehensive theory of linguistic interaction, more specifically, for doing what I promised to do at the end of section 2, namely to put some substance into the constructional hypothesis.

But first, we must have a look a language-games in general

1.5 Some preliminaries of language game analysis. A language game has *inter alia* the following characteristics, which it shares with most other activities that we would like to call games. It has a number of *participants*. The rules of the game may specify or delimit this number and also assign special functions to some or all of them. A *play* of the game consists of a sequence of *moves*, each of which consists of an act by one or more of the participants. For the game to be a language game, we require that at least some of the acts be of a linguistic kind:

acts of speech, writing or signing. The main job of the rules of the game will now be to regulate which moves are permissible and which are not.

To characterize a move in a language game, we need to know the following:[3]

(1) (a) the initial situation (the situation that obtains before the act),
    (b) what the act itself is like,
    (c) the resulting situation.

Rules for language games will tell us how these three things are related for each kind of move. The rules will generally be of the following form:

(2) In an initial situation with characterization A, a move with characterization B leads to a resulting situation with characterization C.

We shall refer to A - i.e. the conditions on the initial situation - as the *presuppositions* of the move, to B - i.e. the conditions on the move itself - as the *performance conditions* on the move. Together, they constitute the *felicity conditions* on the move. (It may not always be quite clear what should count as presuppositions and what should count as performance conditions). C - i.e. the characterization of the resulting situation, can mostly be expressed as a function of A and can often be equated with the rights and obligations of the participants (which can sometimes be formulated in terms of possible future moves). We shall refer to C as the *force* of the move. One may take the position that C equals the *meaning* of a communicative act, a variety of the 'use' theory of meaning.

The following exemplifies what we have said so far. Suppose that in a certain culture, priests marry couples by saying 'I declare you man and wife'. The *presuppositions* of such acts will then include conditions on the participants, such as the person performing the act being a priest, and the persons undergoing the ceremony being an unmarried man and an unmarried woman, and conditions on the setting of the act, e.g. that it takes place in a church and that all the persons involved be present. The performance condition will simply be that the priest should utter the words 'I declare you man and wife'.

The force of the act is that the man and the woman become married, i.e. that they obtain all the rights and obligations that are associated with marriage in that culture.

2 THE CONSTRUCTIONAL HYPOTHESIS ILLUSTRATED

2.1 General. After having looked at some general properties of games, I shall now give an example of how the concept of language-game can be used in an analysis of the meaning of declarative discourses.

2.2 The puppet theater metaphor. Consider the following language-games:

GAME I.

The participants of Game I are called the Master and the Slave.[4]
The Slave is able to perform a number of *actions*.
For each action, there is a corresponding *instruction*.
The only rule of the game is quite simple:
(1) Whenever the Master utters the instruction corresponding to an action, the Slave has to perform that action.

GAME II.

The main difference between Game I and Game II is that there is not just one Slave but several. Each Slave has a *name*.
The rule of the game is:
(2) Whenever the Masters utters the name of a Slave, the game is continued according to (1) with the Master and the Slave named by the Master as participants.

By means of (2), Game II is defined as a sequence of plays of Game I. In effect, what (2) says is the following:
(2') Whenever the Master utters the instruction corresponding to an action, the Slave last named by the Master must perform the action.

Notice that names in Game II function as a certain kind of instruction: instructions to change the roles of the participants in the game, or if we like, to start a new game with new participants. In fact, this is one of the functions of *vocative phrases* in language: they are instructions (or proposals) to assume the role of addressee in a speech act.

GAME III.

In Game III, we introduce another participant, the *deputy master*. Otherwise, the cast is the same. The rule of the game is as follows:

(3) Whenever the Master utters the instruction corresponding to an action, the Deputy Master has to pass on the instruction to the Slave last named and see to it that he performs the action.

GAME IIIa.

Game IIIa is just like Game III, except that the rule is the following:

(3') Whenever the Master utters the instruction corresponding to an action, the Deputy Master has to see to it (by any means, linguistic or other) that the Slave last named performs the action.

GAME IV.

This game takes place in a puppet theater. The cast consists of the *theater director*, the *puppet operator* and a set of *puppets*. The rule of the game is the same as in Game IIIa with the participants correspondingly substituted:

(4) Whenever the Director utters the instruction corresponding to an action, the Operator makes the Puppet last named perform the action.

GAME V.

In this game, we remove the puppets for the time being. The participants are the Theater Director and the Puppet Operator discussing the next play to be performed. The Director informs the Operator of the contents of the play by uttering the very instructions that he would use in the performance according to rule (4). The Operator mentally reconstructs the play by imagining how he, in his turn, would act during such a performance.

Let us now make the further assumption that the play enacted is a documentary one. That would mean that the puppets correspond to real people in the world, and that the actions of the puppets correspond to real actions of these people. In other words, what the Director does is to related a part of the world - a sequence of events - by giving instructions for constructing an isomorphic representation of it.

In a sense then, the instructions for constructing a model can be said to serve as a model by themselves. This analysis throws some light on the relation between the picture theory and the constructional hypothesis. We can take the constructional hypothesis to be a reinterpretation of the naive picture theory where the concept of a picture or a model has been extended.

2.2 Models defined. In fact, what we have said here gives us the possibility of defining a model more generally . The simplistic view of models is that a is a model of b iff a is isomorphic to b, i.e. there is a one-to-one correspondence between the elements of a and b and their relations. We have already seen that this definition is too narrow - it does not cover models of the kind talked about earlier in this section. But it is also inadequate in another way, since an arbitrary isomorphism between two objects is not sufficient for one of them to be a model of the other - we must also know which isomorphism it is. In other words, we need a key (Stenius 1972: 174) which shows us how to 'translate' the objects and relations of the model into objects and relations of the model into objects and relations of the modelled object. A complete model of b will thus have to consist of a - the object isomorphic with b - plus a key which relates a to b. If we like, we can regard this pair, the isomorphic object and the key, as as an instruction which shows us how to re-create b. In this way, we can treat isomorphic representations as 'constructional' models, and we can redefine 'a is a model of b' as 'a shows how to re-create b'.

2.3 Narrative discourses. Game V can be said to provide a model for what happens when a speaker ('the Director') tells a story (i.e. relates a sequence of real or fictive events) to an addressee ('the Operator'). Let us refer to such a speech situation as a *narrative discourse*. An ideal narrative discourse consists of two parts: a set of instructions for constructing (a model of) an initial situation and a set of instructions for performing successive changes in that situation. The initial model consists of a number of *elements* which are in certain *states* and have certain *relations* to each other. The instructions for changing the situation may consist either in operations that change the states or relations of the elements given from the beginning or that introduce new elements into the model. Further, some of the information needed in the model construction may not be explicit in the narrative discourse; the speaker may rely on the addressee having recourse to general programs for model construction.

2.4 Applications to linguistic categories: 'static' vs. 'dynamic'.

Several of the distinctions made in this sketch of an ideal narrative discourse have linguistic relevance. First, we should mention the distinction between 'static' instructions, i.e. instructions for constructing a model of a static situation, and 'dynamic' instructions, which change one state into another. This distinction is reflected in various ways in human languages as aspectual and temporal distinctions.[5] Notice that each dynamic instruction which takes us to a new state also, so to speak, 'moves the narrative forward' in time.[6] Conjoined verbs denoting events are usually interpreted sequentially, e.g.

(1) John opened the door and went into the room

Conjoined verbs denoting states or on-going processes, on the other hand, have an interpretation expressing simultaneity:

(2) It was raining and it was cold.

In the same way, the time adverb then, which follows upon a sentence describing an event, is naturally taken to refer to the moment immediately following upon the event, whereas the same word after a sentence describing state refers to the time when the state holds:

(3) John opened the door. Then he saw Mary.

(4) I was living in a small village. Then I was a small boy.

2.5 'Given' vs. 'new' elements. Another distinction is the one between saying something about or doing something to an existing element in the model and introducing a new element into the model. This is at least one way of interpreting the concepts of 'given' and 'new', which have been discussed by linguists of various schools. The distinction indicates two possible functions of noun phrases, that of referring to 'old' elements and that of introducing 'new' ones. These functions, as is well known, are reflected in stress, intonation, word order and the use of particles in various languages. Cf. for instance, sentence pairs such as

(1) (a) John went into the HOUSE (where John refers to an old element)
(b) JOHN came into the room (where John is introduced as a new element)

Significantly, the second type of sentences have often been referred to as describing an 'appearance on the scene'.[7]

The interpretation of event-describing sentences as instructions to transform a state of affairs into another state of affairs neatly explains the difference which can be found between the status of the initial state and that of the resulting state. In many contexts, the initial state tends to be presupposed (cf. a question like e.g. Have you opened the door in the 'stative' sense). This assumption is natural, since the operation to be performed on the initial state would not be defined if the presupposition were not fulfilled. In this respect, the constructional approach differs from the 'logic of change' of von Wright 1963, for example. According to the latter, a sentence such as The window opens is represented as ~(The window is open) and then (The window is open), where there is no fundamental difference between the two states.

2.6 General model-building programs. Last, but not least, we have the distinction between general programs for model construction and programs for constructing specific models of specific situations. Declarative sentences can be used as elements of both kinds of programs. In the first case, we get sentences of a generic type, such as (1a), to be contrasted with (1b), which describes a specific situation.

(1) (a) John wears dirty jeans
(b) John is wearing dirty jeans

As we said, a speaker usually presupposes that the addressee has at his disposal a set of such general model-building programs. Thus, when putting forward a model for a specific situation, he need only specify the respects in which this model is not predictable from the general programs. These programs can be said to embody the addressee's theory of the world. (What we here call a 'general model-building program' seems to be more or less equivalent to Minsky's concept of a 'frame' (Minsky 1975)). Also generic concepts (such as 'horse', 'table', etc.) may be regarded as programs for constructing models of individual objects.[8]

The instructions in the general model-building programs seem to be applied according to the principle 'If nothing is said to the contrary', i.e. a generic sentence is supposed to hold in a particular instance if the program which specifies that particular situation does not contain any instruction that contradicts it. In the terminology used in artificial intelligence, one would say that the generic sentence specifies a 'default assignment'. So, a generic concept will specify the properties that characterize a typical or ideal specimen of the concept (a 'prototype') rather than the properties that are common to all objects that fall under the concept. We shall return to these problems in 6.3.

The distinction made here between general programs for model construction and programs for constructing specific models of specific situations could be related to the putative distinction made in cognitive psychology between two kinds of memory: 'semantic' and 'episodic' (Tulving 1972). Notice also some related linguistic distinctions. First, on the textual or discourse level, we find an opposition between, on the one hand, what could be called 'descriptive' texts - for lack of a better term - i.e. texts that describe an object or a class of objects, and on the other, what we have here called narrative texts, i.e. texts that relate a sequence of events. Second, on the sentential level, one can make a rough distinction between two types of sentences: one which typically has the structure NP + Copula + Noun/Adjective and which predicates a property of some object and another in which the predicate contains a full verb and which relates some event or process. The following two sentences would be examples:

(2) (a) John is smart
    (b) John opened the door

Sentences such as (2a) differ from sentences such as (2b) by obligatorily having a topic-comment structure (see Dahl 1974 for a more detailed discussion), i.e. they must be understood as being a predication about a certain object, namely the object referred to by the topic NP (here the subject). In the terminology we are using in this paper, they are understood as being instructions for building a model of a certain object rather than for building a model of a situation.

Sentences with generic verbs, such as (1a) are counter-examples to the generalization that sentences pertaining to general model-building programs do not have full verbs as predicates. However, notice that such sentences can often be paraphrased with a nominal predicate, as in (3):

(3) (a) John smokes
(b) John is a smoker

2.7 *Nouns and adjectives*. We said in section 10 that generic concepts, such as 'horse', 'table' etc. may be regarded as programs for constructing models of individual objects. We also said that a generic concept specifies a 'prototype'. The examples we gave of generic concepts were denoted by nouns in English. It might now be interesting to ask if the concepts denoted by adjectives are in any way different from those we have already mentioned.

Traditionally, an adjective is said to 'modify' a noun. The relevance of distinctions between the different lexical classes - nouns, adjectives and verbs - has been denied by, among others, Reichenbach 1947 and the generative semanticists, who have advocated a comprehensive category of 'predicates' as in predicate calculus. On the other hand, Montague 1974 reintroduces the distinction between adjectives and nouns, claiming that adjectives stand for functions from properties to properties, which are in turn functions from possible worlds to sets of whereas nouns (and intransitive verbs) stand for properties, which are in turn functions from possible worlds to sets of individuals (i.e. the individuals that have the property in question in that world). Montague is thereby able to allow for instance the meaning of adjectives such as *small* to be different in *small elephant* and *small animal*.

Further arguments that nouns and adjectives should be regarded as semantically different can be found scattered in the literature, e.g. in Dahl 1971. We can sum up some of them as follows:

(1) Nouns tend to denote complex properties, whereas adjectives tend to denote simple properties.

(2) The denotation of nouns tends to be restricted to a limited universe of discourse, whereas adjectives are often unlimited in their application.

(3) The interpretation of the adjective is often dependent on the noun it syntactically belongs together with.

(4) Nounless noun phrases are felt to be less natural than adjectiveless ones.

I now want to suggest that all these points can be explained naturally if we assume that nouns stand for basic or primary model-building programs, whereas adjectives bring about modifications in these programs by adding, deleting or changing properties in them. (Traditional grammar's view of adjectives as 'modifiers' would thus be basically right).

As an example, we may take the adjectives small and big, which have worried many people (including Montague, as mentioned above). It has been pointed out repeatedly that they involve an implicit reference to a 'norm'. A small elephant is 'an elephant smaller than what is normal for an elephant'. Now, if we suppose that elephant corresponds to a model of a (proto)typical elephant, this model will also specify what size such an elephant is. The result of adding small to elephant will be a model where this size specification is changed. In other words, the norm implicitly referred to is not anything that needs to be added: it is already implicit in the interpretation of elephant.

2.8 Lexical decomposition. We have already said that a model need not be an isomorphic representation of the thing it models. We shall now look at a few further examples and try to apply this observation to the relationship between sentences and the world.

What I shall say here can be regarded as a version of arguments presented in Fodor, Fodor & Garrett 1975 against the reality of semantic representations, but from the point of view of constructional semantics.

Consider the following sequence of letters:

(1) FLIPFLIPFLIPFLIPFLIPFLIPFLIPFLIPFLIP

How can we generate (1)? Here is a possibility:

(2) (a) xxxxxxxxx

(b) substitute FLIP for each x in (a).

We can say that (2a) is a model of (1) and (2b) is the key of the model. (2a-b) illustrates a very simple way in which models may be non-identical to their objects: 'constituents' of the object to be represented need not be present in the model, if the key of the model allows us to substitute other elements for them.

Obviously, a model-constructing system which has access to a large number of such keys can generate very simple models for complex objects. Is there any reason to believe that this is the way that human brains function too? It seems to me that there is. It has long been recognized that there are severe limitations on the amount of information that can be handled at one time by the human information-processing system, notably by the short-term memory (Miller 1956) and that these limitations are largely overcome by encoding known combinations of items into larger 'chunks'. A rule such as (2b) can be seen as an instruction for the creation of such chunks.

This has bearing on the question of 'lexical decomposition'. The theory of lexical decomposition claims that lexical items do not correspond to single concepts but rather to configurations of 'semantic primitives'. For instance, the verb kill has been claimed to be analyzable as 'cause to become not alive'. If we accept the theory of lexical decomposition and try to analyze the conceptual structures that underlie sentences according to it, we find that even rather simple sentences will correspond to structures that are much too complex to fit into an ordinary human being's short-term memory. Consequently, in order to store such a representation, it must be re-analyzed into a small number of chunks. So what would chunks be? A natural alternative is to suggest that they are the configurations that correspond to the lexical items that appear in the sentence. But that implies that there is a level on which lexical items are not in fact decomposed but appear as atoms. This analysis, in its turn, makes one wonder what the status of the decomposed representation is in the actual cognitive processes of human beings.

So-called 'meaning postulates' have been proposed as an alternative to lexical decomposition. Meaning postulates are rules that state semantic equivalence relations between expressions. For instance, instead of saying that kill is decomposable into the elements indicated above, one could give the following meaning-postulate:

(2) x kills y ≡ x causes it to come about that y becomes not alive

We can now suggest that a sentence containing the verb kill is stored in the short-term memory in a form similar to the left-hand half of (2), whereas the decomposed version found to the right of the equivalence sign is stored in the long-term memory (in what corresponds to the linguist's lexicon) and is retrievable if needed. Equivalence statements are only one kind of information contained in the 'lexical entry'. For instance, a noun denoting a generic concept must be associated with all kinds of information about the entities that fall under the concept. Of course, it is not necessary that the stored information be expressible in linguistic form. Concepts can be organized in a hierarchy ranging from purely 'observational' or 'concrete' ones to purely 'theoretical' or 'abstract' ones. The rules connecting the different levels in such a hierarchy are probably such that they can be expressed in words, but the closer we come to the 'observational' end of the hierarchy, the more necessary it will become to have rules that relate the concepts directly to perceptual categories. The knowledge of a person who understands the word red can hardly be expressed linguistically.

I used to be sceptical about the idea of using meaning-postulates in a semantic theory because of their syntactic character (syntactic in the sense of 'pertaining to relations between expressions'). Now I think that such a use is quite legitimate, as long as one does not assume that meaning postulates exhaust semantics.

3 PROPOSALS AND CONTRACTS

3.1 The Proposal Game. In the following sections, we shall often discuss the concepts of *proposing*, *accepting* and *rejecting* in language games. To start with, let us look at a game called the *proposal game*:
This game is like Game I (2.2), except that its rule is the following.

(1) Whenever the Master utters the instruction corresponding to an action, the Slave either
  (a) performs the action
  or
  (b) utters No.

We say that S *accepts* the proposal in (a) and *rejects* it in (b). Basically, the distinction between a command and a proposal lies in the possibility to reject. Game I and the Proposal Game are two 'ideal cases'. Many actual 'language games' lie somewhere between them in the sense that S may accept or refuse to comply with a command/proposal only under certain circumstances.

3.2 Accepting and refusing. There are actually two senses of 'accepting another participant's move' in a language game, which we shall refer to as 'accept$_1$' and 'accept$_2$'. 'Accept$_2$' is the sense which was exemplified in the Proposal Game, and is applicable only to moves that can be characterized as 'proposals' in the widest sense of the word. 'Accept$_1$' on the other hand can be applied to basically any move in a language game or in a game of any other type as well. It involves accepting the other participant's move as a 'felicitous' instance of the type of move he intends it to be interpreted as. In most cases, this means to acknowledge that the move is made in accordance with the rules of the game. Let us illustrate the distinction between the two kinds of acceptance with an example from a formalized situation such as a meeting of some legislative body. Suppose that someone puts forward a proposal for a resolution. As a member of the legislative body, I may then argue against this proposal in two ways: (a) suggest that the person who put it forward had no right to do so (i.e. argue against accepting$_1$ the proposal), (b) try to show that the proposal is bad and should not be accepted$_2$. Similarly, the legislative body can refuse to accept the proposal in two ways: either by deciding not to acknowledge it as a proposal or by acknowledging it as a proposal but voting 'no' on it.

As we see, accepting$_2$ presupposes accepting$_1$ (hence the choice of indices). The distinction between the two kinds of acceptance is important for the understanding of the differences between commands and proposals. Even if a command must be accepted in the first sense, one can often refuse to accept it in the second sense. (In many cases, one then has to turn to a higher authority (in 'game' terms a 'referee') who decides whether the move was correct or not).[9]

3.3 'Yes' and 'no'. Acceptance and rejection of a move can be indicated in many ways. One of the alternatives may not be explicitly stated at all. The most general explicit verbal indicators seem to be the words yes and no. (other examples are OK, well, aye and all right for acceptance and stop for rejection).

Yes and no are probably mostly thought of as answers to questions, which might lead one to associate them with the truth-values 'true' and 'false' rather than with acceptance and rejection. Such an account of the basic meaning of these words would however raise problems with the equally common cases when they are used as reactions to declarative and imperative sentences. It should be noted that it seems to be possible to use yes for both kinds of acceptance and probably also in some cases for signalling understanding without acceptance (although it is hard to find any clear-cut cases).

3.4 The Contract Game. An important modification of the game called The Proposal Game above is the *contract game*. In the minimal case of the Contract Game, there are two participants, whom we can call simply A and B. The main difference from the Proposal Game lies in the nature of the proposal. What is proposed here is a *joint course of action*. A simple case would be if one of the players, say A, proposes one action for himself an another for B. (This presupposes that the language of the game contains names or other means for referring to the participants themselves).

An important feature of the Contract Game is that the player who puts forward the proposal also makes a commitment as to his own future actions.

3.5 The Generalized Contract Game. We shall now propose a kind of generalized 'supergame', which will include a number of the games we have treated earlier as special cases. If we return to the Proposal Game, we can see that there is an alternative way of analyzing it with the help of the concept 'model of the world'. In the course of a Proposal Game, the Master proposes that the Slave perform various operations. Another way of putting this is to say that the Master proposes a certain model of the world (i.e. one where the Slave performs the operation in question) which the Slave is to undertake to see to it that it comes true. We see that imperative and declarative games both have in common that the speaker proposes a certain model of the world which is to be regarded as being true (or becoming true), but the difference lies in the existence in the imperative cases of a person who is responsible for seeing to it that the model becomes true. In the declarative case, the goal is to make the model fit the world, in the imperative case, to make the world fit the model. Searle 1976 has used the term 'direction of fit' to denote this distinction, which we shall return to in 6.1.

The Generalized Proposal Game will look something like the following: For each round in the game, there is a player or a set of players, called the Proposer(s), who put(s) forward the proposal. Then there is a player or set of players called the Undertaking Party(ies), who, if the proposal is accepted, undertake(s) to see to it that the proposal or some part of it becomes true. (Different players may of course be responsible for different parts of the proposal). This analysis already makes it possible to distinguish a number of game types which can serve as a basis for a taxonomy of speech acts.
In a declarative game, the set of Undertaking Parties does not include the Proposer. When the set of Undertaking Parties is identical to the set of Proposers, we are dealing with a Promise game. Of course, there may also be mixed cases.

Games are also distinguished according to the Procedure of Acceptance, i.e. how a proposal comes to be accepted. In a

Command Game, the Procedure of Acceptance is automatic, i.e. every well-formed proposal is automatically accepted. In such a case, there must usually be restrictions on who can make proposals (in the terminology used above, who is 'Master'). In other games, there may be more or less democratic procedures for deciding on proposals. (Notice that proceedings of committees, legislative bodies etc. can largely be regarded as special cases of the Generalized Proposal Game).

Further distinctions arise when we consider what we can call the Official Motivaltion of the proposals. A player may put forward a proposal which he explicitly or implicitly claims to be in the interest of some player. If the interested party is identical to the Proposer, we most probably are dealing with a request ('Do this for my benefit'). If the Interested Party is someone else, in particular the Undertaking Party(ies), the proposal can be characterized as a piece of advice ('You should do this for your own best advantage'). If the Proposer explicitly or implicitly claims that the proposal must be accepted because of some rule within or outside the game, we are dealing with a demand (which overlaps with commands to some extent).

3.6 'Pseudo-conditionals'. Consider the following types of sentences:

(1) Give me a dollar and I'll save your life.
(2) Give me a dollar or I'll shoot you.

These seem to be paraphraseable as conditional constructions, as in (1'-2'), and we shall therefore refer to them as pseudo-conditionals.

(1') If you give me a dollar, I'll save your life.
(2') If you don't give me a dollar, I'll shoot you.

Not surprisingly, it has been suggested (Lakoff 1966, but cf. also Lakoff 1974 for another treatment) that pseudo-conditionals are transformationally derived from conditionals. Although such a hypothesis 'accounts for' at least part of the semantic properties of these sentences, it does not, of course, constitute an explanation of them in the true sense. It seems that such an explanation must be formulated in pragmatic terms, and the Generalized Contract Game, as presented above, suggests a possible direction in which this explanation can be sought.

Notice that, characteristically, such pseudo-conditionals consist of an imperative clause, in which the addressee is requested to perform an action, and an indicative clause, in which the speaker commits himself to some other action which is to be performed under the condition that the first action is carried out. In other words, the whole sentence constitutes a complex proposal for joint action. The characteristic property of such a complex proposal is that it does not consist of two independent proposals which can be accepted or rejected one by one but rather of two elements that must be accepted or rejected together - in other words, a 'package deal'. This fact then accounts for the conditional force of such pseudo-imperatives: the promise expressed in the second clause is given only under the condition that the addressee accepts the undertaking expressed in the first clause.

Notice that if the action expressed in the first clause is impossible to perform, the promise loses its force altogether. The sentence may still have a point, though, as is exemplified by Archimedes' famous utterance (3), which can be understood in a pure conditional sense:
(3) Give me a fixed point and I shall move the earth.

The 'package' property of these pseudo-conditionals clearly depends on the fact that they are conjoined with and. Anticipating the discussion of logical operators, we can say that the function of and in a Generalized Contract Game seems to be to indicate that all the conjuncts have to be accepted together. If we instead choose or as connective, we instead get a proposal to accept at least one of the disjuncts. Accordingly, what (2) means is that the addressee has to choose between giving the speaker a dollar and being shot. What this analysis does not explain, however, is why pseudo-conditionals with or tend to be used only as threats, i.e. why a more civil proposal of the following kind sounds rather funny if we choose this construction:
(4) Mail this letter today or I'll do it tomorrow

3.7 Statements as proposals. Let us now return to declarative discourses. We have earlier suggested that declarative discourses are instructions to construct models of the world. However, a more adequate description of what happens in many declarative discourses is that the speaker puts forward a proposal for a model of the world which is to be jointly adopted by the participants in the conversation. As is the case with all proposals, the reaction to a statement is that one checks it against one's stored picture of the world, seeing what kinds of changes or additions it entails.

We see that what happens in declarative discourses is very similar to what happens in the Contract Game. The 'contract' character of a declarative discourse is important for the understanding of (pragmatic) presuppositions. If one of the participants makes a statement and this statement is accepted by the others, the content of the statement is presupposed in the discourse that follows, in the sense that the participants have jointly agreed to treat it as true.

In this connection, we might also discuss the relation between ordinary declarative discourses and 'hypothetical' discourses. The difference between stating that p and saying 'Let us assume that p' is one between making a proposal about the model of the world that the participants in the discourse regard as the real one - i.e. the one that corresponds to the real world - and proposing that a certain model be temporarily adopted just to see what happens (as an experiment, so to speak). Notice that words like assume and suppose are in fact ambiguous between these two alternatives.

A *fictional* discourse, on the other hand, is a 'make-believe' declarative discourse, where the participants just pretend to take the model proposed seriously.

In all three kinds of declarative discourses, ordinary, hypothetical and fictional, the same kind of model construction takes place, but there is a difference in the status of the model (whether it is intended to be the 'real' model of the world or not).

3.8 Explicit performatives. In connection with the Generalized Contract Game, we should also mention so-called explicit performatives. Although much attention has been devoted to performatives recently, astonishingly little has been said about the problem of how one can actually do things by stating that one does them, e.g. why an utterance of the form 'I promise to do X' can function as a promise to do X. I think at least part of the explanation is found in the contract character of declarative speech acts. A speaker who says 'I perform move X' is proposing to the other participants in the language game that a model of the world be accepted in which he performs move X. If they accept this proposal, they thereby also accept that he has performed the move in question, which means that, as far as the game goes, he has actually performed the move.

4. EXTENSIONS OF COMMAND GAMES

4.1 Introducing logical operators. What should a formal constructional semantics be like? Most of the rest of this paper will be devoted to this question. In any formal system of semantics, the treatment of 'logical operators', such as negation, propositional connectives (*and*, *or* etc.) and quantifiers will be of fundamental importance. This is also one of the areas where the naive picture theory gets into difficulties. We may accept that a sentence such as (1) is isomorphic with the situation in which Mary kisses John, but it is much less natural to regard (2) - the denial of (1) - as isomorphic with the situation in which Mary does not kiss John.

(1) Mary is kissing John
(2) Mary is not kissing John

Our strategy will be the same as the one used in 2, i.e. we will start with the very simple game introduced in that section under the name Game I and then modify it in various ways, successively obtaining more complicated games.

4.2 The And-Or Game. The *and-or game* is obtained from Game I by adding to the set of possible instructions such instructions as are obtained by the following two rules:

(1) If p,q,r... are instructions to perform the actions O_p, O_q, O_r... then AND (p,q,r...) is an instruction to perform the complex action which consists in performing all of O_p, O_q, O_r ...

(2) If p,q,r... are instructions to perform the actions O_p, O_q, O_r..., then OR (p,q,r...) is an instruction to perform one of O_p, O_q, O_r...

4.3 Permissions and prohibitions. We now proceed to negation, which will be introduced in several steps.

NEG-GAME I

There are two participants, called A and B. As in Game I, there are actions and corresponding instructions. The rule however is rather different:

(3) Each round of the game starts with B uttering the instruction corresponding to some action. Then A says 'yes' or 'no'. If A says 'yes', B may perform the action. If A says 'no', the round is finished.

The games we have talked about earlier have been what we can call *command games*. Neg-Game I is an example of what we call a *permission-and-prohibition game*. There are several variants of Neg-Game I, e.g.

NEG-GAME II

This game is like Neg-Game I except in that A remains silent rather than say 'yes' when he permits something.

NEG-GAME III.

Here we introduce the further modification that B is allowed to indicate in any way he likes what action he has chosen (i.e. he does not have to make it verbally).

NEG-GAME IV.

Here, B does not have to indicate what he is going to do at all. It is A's task to guess his intentions. In all other respects, the game is played as Neg-Game II.

This last game is of particular interest, since it comes quite close to something that happens at an early stage in child development, with the child in the role of B and the supervising parent in the role of A. From an ontogenetic point of view, it is quite natural to start the analysis of negation with such a game, since it appears to be the first kind of situation in which the child comes in contact with a negation-like word.

Before we get to other kinds of prohibitions than this most elementary one, we have to complicate our games a little. In the games introduced so far, A cannot control B's behavior before B has indicated what he intends to do. But suppose that we want A to be able to control B's behavior in advance. He could do so if we allowed him to indicated his own future moves by saying 'If you make move X, I make move Y'. Applied to Neg-Game I, this means that A would be able to say things like 'If you choose operation X, I say yes' or 'If you choose operation X, I say no'. A would then be able to *permit* and *prohibit* B to do things in advance. We can obtain this result by extending Neg-Game I to include A's moves formed with the operators PERMIT(x) and PROHIBIT(x), which are defined by rules of equivalence:

(4) A move of the form
A : PERMIT(p)
is equivalent to a move sequence of the form
B : p
A : yes.

(5) A move of the form
A : PROHIBIT(p)
is equivalent to a move sequence of the form
B : p
A : no.

In natural language, there are of course various ways to express permission and prohibition. The simplest is with plain imperatives and negated imperatives respectively. A few points can be made in this connection. An imperative sentence, such as Come in! is ambiguous between a command an a permission. In an analysis of the kind we are attempting here, this ambiguity is explained in terms of differences between the language games that the utterances

appear in. Further, we see that there is no such ambiguity in the negated imperative Don't come in![10] In other words, there is no place for negation within the command game. The introduction of negation entails a more complicated game.[11]
One other thing that we have wanted to attain with our analysis is to show the relations between rejecting and negation. The different permission-and-prohibition games we have outlined here should suggest a possible way in which the negated imperatives could develop out of a simpler kind of rejection.[12]

4.4 Free choice permission. We should now consider how the operators AND and OR can be added to the permission-and-prohibition games. We get at least four combinations of PERMIT and PROHIBIT with these operators:

(1) (a) PERMIT (AND (p,q,r...))
(b) PROHIBIT (AND (p,q,r...))
(c) PERMIT (OR (p,q,r...))
(d) PROHIBIT (OR (p,q,r...))

How should these be interpreted? To find out, we combine (4) and (5) in 4.3 with the rule for interpreting PERMIT and PROHIBIT. This yields the following results:

(2) (a) If you choose to perform the complex operation consisting in performing all the actions $O_p, O_q, O_r \ldots$, I'll say yes.
(b) If you choose to perform the complex operation consisting in performing all the actions $O_p, O_q, O_r \ldots$, I'll say no.
(c) If you choose to perform at least one of the actions $O_p, O_q, O_r \ldots$, I'll say yes.
(d) If you choose to perform at least one of the actions $O_p, O_q, O_r \ldots$, I'll say no.

This analysis corresponds well to the following English sentences:

(3) (a) (You may) open the window and close the door
(b) Do not open the window and close the door
(c) (You may) open the window or close the door
(d) Do not open the window or close the door

This result is not entirely trivial. Alternative analyses of (3a-d) have been given within so-called deontic logic (e.g. Anderson 1966). In systems of deontic logic, the formalization of (3c) is problematic, since with the ordinary interpretation of such systems - along the lines of a possible world semantics - a formula like (4a) is true whenever (4b) or (4c) is true.

(4a) Permitted (p or q)
(4b) Permitted (p)
(4c) Permitted (q)

In such a semantics, 'permitted' is interpreted as 'true in at least one permitted state of affairs'. Now if *p* is true in a state of affairs, any disjunction of *p* and another proposition will also be true (according to the usual truth-functional interpretation of disjunction). It follows that, in order for (4a) to be true, it is sufficient that *p* be true in at least one permitted state-of-affairs - if this condition is fulfilled, (4b) is also true. But we cannot conclude (3c) from a sentence like (5).

(5) You may open the window

The problem is pointed out by Anderson (1966: 180), who, however, is content to conclude that 'or' in ordinary English contexts of the for '*p* or *q* is permitted' is used in a a sense more closely approximating the truth-functional sense of 'and'. In a system like that presented by Anderson, (3c) would have to be represented as (6)

(6) Permitted (*p*) and Permitted (*q*).

The problem is also treated in Kamp 1974, whose solution resembles ours, although the framework is slightly different.

4.5 *Rules vs. commands*. In introducing the P & P Game II, we came close to a situation where a player is allowed to change the rules of the game. We shall now develop this possibility further. Generally, if we have a game with a given set of participants and a given set of rules, we can construct a kind of meta-game in the following way. We postulate that under certain circumstances, one or more of the players (the old ones or new ones that are added to the cast) are allowed to introduce changes (or propose changes) in the rules of the game. We must then consider the form of such rules. A type of rule commonly needed is one which says that under certain circumstances, some player is to perform such-and-such an action. Such a rule needs to indicate

(1) (a) the circumstances - the sets of situations - in which it applies,
  (b) what players it applies to,
  (c) what action they are to perform

The language used to express rules of this kind thus needs, among other things, ways of referring to the entities in (a), (b) and (c). Of particular importance is the fact that it must be able to refer to sets of situations. There are of course many ways of doing so. An important possibility is provided by declarative games, which contain instructions to construct models of the world. One way of referring to a set of situations is to say 'Given that such-and-such a model-constructing instruction has been applied...' In natural language, conditional and temporal clauses have this function.

One may regard this kind of rule as an 'equivalence statement' of the kind we exemplified in (RCII a-b). Thus, instead of saying that a certain action is to be performed in a certain situation, we may say that such and such a situation is equivalent to a command to perform the action.

Let us now compare a rule-introducing utterance with a command.

(1) Whenever it is cold, close the window.

(2) Close the window.

Both (1) and (2) introduce obligations to close the window, but there is at least one essential difference between these obligations. In (2), the force of the obligation disappears once the window has been closed; in (1) on the other hand, the fact that the rule has been applied once does not affect its force for the future. We shall say that (2) is a *telic* obligation, whereas (1) is an *atelic* obligation (Comrie 1976).

5. CONSTRUCTIONAL VS. TRUTH-CONDITIONAL SEMANTICS.

5.1 A constructional approach to predicate logic. We shall now show how the semantics of predicate logic can be given in 'constructional' terms. This step will allow us to see how the treatment of logical operators for imperatives can be extended to declaratives. The reason that we use predicate logic instead of natural language in this section is that the model-theoretical semantics of the former is well-known and our goal here is limited to showing how the logical operators work.

A 'model' or 'possible world' in model-theoretical semantics is an ordered pair consisting of a domain D - the set of all objects existing in the world - and for each n-place predicate R a set of n-place sequences of members of D, viz. the set of sequences for which R holds (We refer to this set of sequences as the *extension* of R). This kind of 'model' or *relational structure* is also the point of departure for our analysis.

Two relational structures S_1 and S_2 can differ in various ways. To start with, it may be the case that for each R, the extension of R in S_1 may be included in the extension of R in S_2. In other words, if a sequence belongs to the extension of R in S_1, it also belongs to it in S_2. If this holds for all relations, we say that S_1 is *embeddable* in S_2. We may now consider how one could go about constructing a relational structure. One simple way is to start by assuming that the extensions of all predicates are empty to begin with and that members are then added to them, step by step. At each stage in this process, we will then have a relational structure into which all the preceding structures are embeddable.

A relational structure can thus be generated by 'instructions' of the form:

(1) Add the sequence <a,b,c...> to the extension of R_i.

An atomic sentence in predicate logic has the form exemplified in (2):

(2) R_i (a,b,c...)

We can now view (1) as providing the interpretation of such atomic sentences. It can easily be seen that the set of all atomic sentences true in a world w will actually generate the relational structure which corresponds to w.

An atomic sentence can thus be seen as a direct instruction to perform a certain model-building operation, viz. to add a certain sequence to the extension of some predicate in the model. It is not always the case that one can proceed so straightforwardly in constructing models of the world. This is where complex sentences and logical operators come in. They allow us to formulate instructions even if we have only indirect information about the model.

We shall start with the operators of propositional logic, which have already been introduced for imperative language games. To transfer them into this kind of discourse presents no insuperable difficulties.

A set of sentences connected by conjunction (*and*) will, as before, be interpreted as an instruction to perform all the operations (actions) specified in the constituent sentences.

A set of sentences connected by disjunction (*or*) will, also as before, be interpreted as an instruction to perform at least one of the operations specified in the constituent sentences. It is important to notice that this is a disjoined command rather than a disjoined permission ('free choice permission'). It is not up to the listener to choose just any of the constituent sentences he happens to like: he must choose one only when he is sure that his choice is correct. The instruction is thus not one that can be carried out at once: one must wait and see what happens in the future.

A conditional sentence will be interpreted as an instruction to perform a certain operation under the condition that a certain other operation has been performed. Here, the same can be said as in the case of disjunction: this is in most cases a kind of instruction that must be stored in expectation of further information. A negated sentence will finally be interpreted as a prohibition to perform a certain operation.

We shall have to modify what was said in the last two paragraphs later on, but it should already be pointed out that all these complex instructions have the character of permanent rules:

once introduced, they must be obeyed until they are explicitly cancelled. A negated sentence, for instance, cannot be regarded just as a prohibition to perform a certain operation at that very stage of the model-building process but rather as a prohibition to perform it at any stage. Otherwise, negated sentences could be interpreted as just expressing uncertainty (i.e., one says that one does not want to make an assumption in the present state of knowledge).[13]

We now proceed to the quantifiers. For the universal quantifier, we suggest the following rule:
(3) Interpret $\underline{\forall x\ F}$ as an instruction to perform the operation specified in $\underline{F'}$ to each element in the domain, where $\underline{F'}$ is the instruction obtained by substituting an individual constant denoting that element for $\underline{x}$ in $\underline{F}$.

(3) should also be interpreted as a permanent rule, not as a command which can be carried out at once. New elements may be added to the domain later on, and the universal statement will also have to be applied to them.

The introduction of new individuals is brought about by the existential quantifier:
(4) Interpret $\underline{\exists x\ F}$ as an instruction to perform the operation specified in $\underline{F'}$, where $\underline{F'}$ is the instruction obtained by substituting an arbitrary new individual constant for $\underline{x}$ in $\underline{F}$.

5.2 Existential and identity statements. The treatment of the existential quantifier is one of the main differences between the constructional and the ordinary model-theoretic approach. The difference has to do with the role of the 'domain' in both approaches. In the model-theoretic approach, the domain at a certain point in the model-building process is the set of individuals that are 'known' so far. This set grows continually as new individuals are introduced. The advantage of the constructional approach here is that it seems to resemble more closely what actually happens in the understanding of discourses.

A few words are needed on the nature of the 'individuals' we are talking about. Actually, the rule we formulated mentioned only individual constants, not individuals themselves. It is clear that we cannot assume a one-to-one correspondence between individual constants and individuals in the world: it may turn out that we have been referring to one and the same individual by two names. However, as far as the model goes, any existential statement (as long as the existential quantifier is not within the scope of another operator) introduces a new element, which is to be regarded as distinct from all others as long as contrary evidence is not obtained. We shall illustrate this by exemplification from natural language.

(1) Someone has stolen my bike.

If (1) is true, it is true of some individual that he has stolen my bike. It may be some person that I know well, say my friend John. However, as long as I do not have any information to the contrary, I must treat the person who stole my bike as separate from all other individuals.

This concept of 'individual' is more or less the same as that for which the term 'discourse referent' has been used (Karttunen 1969). The term 'referent' may be misleading, however, since it suggests something in the world, so in the following discussion we shall use the locution 'element of the domain' or, when no misunderstanding can arise, 'element of the model'.

The constructional approach should make it easier to treat anaphoric expressions that refer back to indefinite noun phrases, as in

(2) Someone has stolen my bike. He will soon be caught.

The translation of (2) into predicate logic is troublesome. One might suggest paraphrasing (2) as a conjoined statement, but this means neglecting the fact that it consists of two statements; and in any case it will give logically non-equivalent results in cases like the following.

(3) Few people have read the manuscript. They have sent me their comments.

(4) Few people have read the manuscript and sent me their comments.

The problem is that there is not natural way to ensure that we refer to the same individuals in these two clauses - in fact, there is no clear sense in which a variable bound by a quantifier refers at all, which makes the notion of co-reference rather dubious for such cases.

The treatment of indefinite NPs suggests in a natural way a similar treatment for identity. An identity statement of the form a=b can be regarded as an instruction to converge two elements in the model. The identity 'predicate' in such a theory - being an instruction to perform operations on elements in the model - would thus be quite different in its semantic role from other predicates, which is what we would expect intuititively.

Actually, it does not matter very much what an 'element of a model' is considered to be. Of course, one may think of it as a mental entity of some sort. For those who have prejudices against such things, it is possible to envisage quite concrete 'models' that will work as well. One may for instance construct a model out of a number of boxes, one for each predicate, into which we put marbles of different colors, one for each individual. An equivalent way is to use the individual constant letter themselves. For each predicate, we then write the corresponding sequences on a separate sheet of paper. Notice, however, that an individual in such a model corresponds to a 'type' of marble or letter rather than to a 'token'.

5.3 Models of individuals. We have shown how a semantics can be given for the predicate calculus which builds on the assumption that sentences are instructions for building up models. The kind of 'model' we assumed was chosen in order to deviate from the ordinary truth-conditional semantics as little as possible. As a theory of how we organize our knowledge of the world, our account may be less plausible, however. It does not seem very probable that our world models consist of huge lists of sequences of individuals, one list for each predicate in our language. One proposal which is at least as attractive would be to organize the knowledge of the world taking individuals as the primary units - an approach chosen in many computer systems for representing knowledge.

We may think of a model as having as its parts models of the individuals that are its 'elements'. How could we obtain such a model of an individual? One simple way would be to regard the set of all model-building instructions, i.e. statements, that mention the individual in question as a model of that individual. Such a model would then be secondary in relation to the kind of model we have been talking about so far.

Suppose now that we have the following set of statements about an individual *a*, expressed in the language of predicate calculus:

(1) (a) F(a)
    (b) G(a)
    (c) H(a,b)
    (d) J(a,a)
    (e) K(b,a)

We see right away that (1) contains some redundancy. The constant *a* appears in each line of it. Is there a simpler way of writing (1)? In the case of one-place predicates such as *F* and *G* in (1), the question seems simple enough. We can just delete *a* without any ambiguity arising. The same thing can be done in (1c), if we introduce the principle that the first argument can be deleted. In the case of (1d) and (1e), we need some extra machinery. Suppose we introduce a converse operator *CONV* which is such that *CONV(F) (x,y) ≡ F(y,x)*. We can then re-write (1d) as *CONV(K)(a,b)* and then delete *a*. For (1e), there are several possibilities. We can introduce an operator REFL which is such that *REFL(F)(x) ≡ F (x,x)*. We can also introduce a special kind of individual term, say *r*, which is interpreted according to the rule that it always has the same reference as the first argument of the predicate. In the latter case, (1e) would be re-written as *J(r)*. We have now arrived at the following 'property list' for *a*:

(2) F,G,H(b),CONV(K)(b),J(r)

In addition to being more compact than (1), a representation like (2) is of independent interest. First, it allows a direct comparison of different individuals, since the same property list may now be applied to them all. Second, the mechanisms we have introduced in order to convert (1) into (2) have very close parallels in natural language, namely passive verb formation and reflexive pronouns. What we have said suggests another way of interpreting a sentence of the form F(a), namely as 'Add the property F to the model of a'. In natural language, sentences tend to have a subject-predicate or topic-comment structure, i.e. predications of a property about an individual, rather than predications of n-place relations to n-place sequences of individuals. The grammatical devices we mentioned can be seen as having the function of making it possible to give such a bipartite structure to statements that would not otherwise have it.

5.4 Comparison with Hintikka's principles for model set construction.

The 'constructional' approach outlined in section 25 bears a number of resemblances to the conception outlined in chapter I and II of Hintikka 1973. Hintikka introduces the notion of MODEL SETS, which are said to be 'partial descriptions of possible states of affairs'.

A model set is constituted by a consistent set of sentences. Consistency is ensured by a number of conditions that are essentially reformulations of the truth-conditions of the sentential connectives and of quantifiers. For instance, we have to require the following:
'If (F & G) ∈ M, then F ∈ M and G ∈ M, and vice-versa' (1973:11)

Hintikka now suggests a way of looking at the usual rules of proof in first-order logic (quantification theory):
'A proof of F can be conceived of as a disproof of ~F; hence it suffices to consider disproofs only. A disproof of G can now be thought of as a way of showing that G cannot be embedded in a model set. The conditions defining a model set show us at once a way in which we may try to show this: we may start from the unit set {G} of G and try to extend it into a model set by adjoining to it one by one the members which it does not have but which it ought to have if it were a model set. If all these ways of trying to embed G into a model set lead to a violation of the condition...it is easy to show that G is inconsistent...'(1973:12).

In an Appendix to Chapter I, Hintikka presents a set of 'Rules for Model Set Construction' built on the idea outlined in the quotation above:

'Assume that λ is an approximation to a model set. Then a new approximation can be obtained by means of an application of one of the following rules:

(A. &) If $\underline{(F_1 \& F_2) \in \lambda}$, add $\underline{F_1}$ and $\underline{F_2}$ to $\underline{\lambda}$...' (1973:24)

One can arrive at our approach by modifying Hintikka's in the following way. First, we can obtain an object which is isomorphic to our 'relational structures' if we strip the model sets of all complex sentences, leaving only the atomic ones. Each atomic sentence will then correspond to a sequence in the relational structure. Now we see that the rules for model set construction that Hintikka gives can be taken as interpretation rules for complex sentences in our framework after a slight modification. For example, the rule quoted above can be rewritten as

(1) Interpret $(\underline{F_1} \,\underline{\&}\, \underline{F_2})$ as an instruction to apply $\underline{F_1}$ and $\underline{F_2}$ to the model.

Thus, the approaches can be regarded as roughly equivalent. Although Hintikka's 'game' was primarily intended to show how one can fill out an incomplete model of the world by logical inference, our model is intended to be a simulation of what happens when someone tells someone else something about the world, thereby adding information to the listener's model which could not necessarily be obtained by logical inference.

5.5 Truth-conditions vs. model-building instructions.

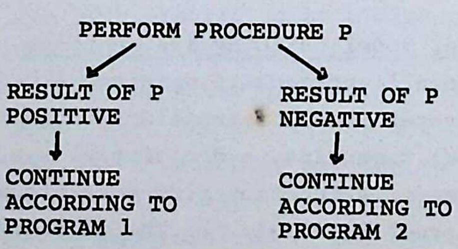
In the 'constructional' approach to meaning, a declarative sentence is interpreted as an instruction to construct a model. In truth-conditional semantics, a declarative sentence is interpreted in terms of a function from possible worlds (models) to truth-values ('true' and 'false'). The difference between the two approaches is perhaps best explained by a metaphor.

Imagine a factory with two kinds of employees: workers and controllers. The workers assemble toys of a certain type according to written instructions. The controllers take the completed toys and check that they were made in accordance with the instructions. They put them into two boxes: one labelled 'approved' and another labelled 'not approved'. The instructions for assembling the toys can be said to correspond to a sentence or set of sentences. The toys correspond to possible worlds or models of possible worlds. We see that the difference between what the workers do and what the controllers do lies in the use they make of the instructions - in the case of the workers, as a guide for constructing the toys and in the case of the controllers, to sort the toys into two categories. In the same way, the two kinds of semantics differ in the 'procedure' that is associated with the interpretation of a declarative sentence.

Of course, for a number of possible applications of a semantic theory, it is completely irrelevant which of the two alternatives we choose. However, it seems to me that, when it comes to describing what actually happens when a person understands a statement, the constructional approach is intuitively much more attractive. This does not mean, though, that the constructional approach is the best alternative for all kinds of 'language games'. In fact, it seems to me that in a number of cases, truth-conditional semantics is preferable.

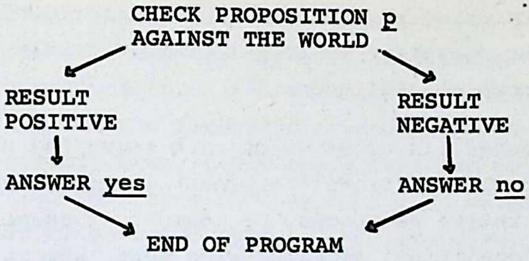
Consider again what the controller in our example does. He takes an object, checks it against some kind of specification, and depending on the outcome of the checking procedure, does one of two things. What he does can be represented in the following flow-chart:

(1)


PERFORM PROCEDURE P
RESULT OF P POSITIVE
RESULT OF P NEGATIVE
CONTINUE ACCORDING TO PROGRAM 1
CONTINUE ACCORDING TO PROGRAM 2

Let us call a procedure of this kind a *yes-no procedure* An obvious example of a yes-no procedure is what happens when a person answers a yes-no question (this is of course the motivation for the name). In fact we may regard a question as an instruction to perform a procedure of the following kind:

(2)


CHECK PROPOSITION p
AGAINST THE WORLD
RESULT
POSITIVE
RESULT
NEGATIVE
ANSWER yes
ANSWER no
END OF PROGRAM

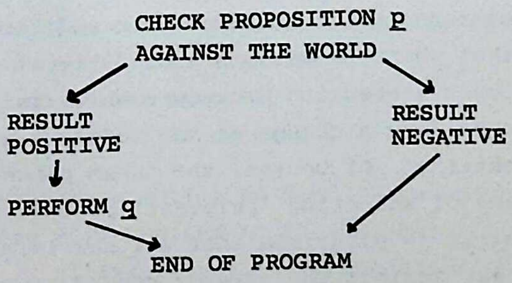
The trouble here of course, lies in the interpretation of the instruction 'check proposition *p* against the world'. Another way of expressing it is 'Check if *p* is true in the world'. Truth-conditional semantics is or is claimed to perform exactly this kind of task.

How than can 'truth in a model' be defined in a way that can be related to the semantics we have already given for declarative sentences?

Basically, we can say that a sentence is true in a model iff it is interpreted as an instruction such that this model could be reconstructed by executing a model-building program in which the instruction is embedded. This formulation, of course, may be seen as no more than defining one troublesome concept by another troublesome concept. Hopefully, it may clarify a few problems and draw attention to some others.

Interrogative language games are not the only cases where yes-no procedures occur. One other fairly obvious case is that of conditional constructions, which have been treated briefly above. A conditional command, of the form
If p, perform q can be analyzed as follows:

(3)

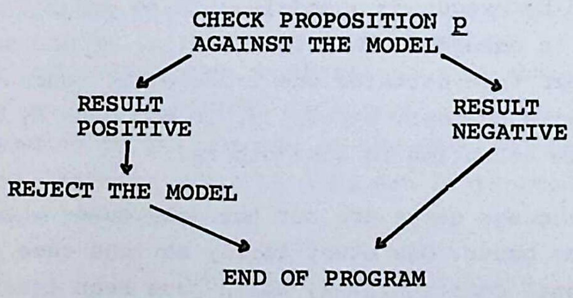

CHECK PROPOSITION p
AGAINST THE WORLD
RESULT
POSITIVE
RESULT
NEGATIVE
PERFORM q
END OF PROGRAM

A conditional declarative construction will differ from (3) only in that the operation to be performed (or rule to be applied) is a model-building one.[14]

Conditional clauses, in other words, are among the constructions for which a 'truth-conditional' approach is more adequate than it is for declarative sentences. Of course, it is no accident that the word 'condition' appears twice here. Nor is it accidental that truth-conditions of the Tarskian type are formulated as conditional constructions.

Another construction which seems to fall in the same category is that of negative sentences. Earlier, we suggested that a negated sentence is interpreted as a prohibition to perform a certain operation. One difficulty with such a proposal is that it is not clear what happens if the operation has already been applied to the listener's model of the world, i.e. if he holds a belief which contradicts the negated sentence. This difficulty may be avoided if instead we assume that a negated sentence $\sim p$ is interpreted as a yes-no procedure of the following kind:

(4)



As was said earlier, to understand how conditional and negative sentences work, it is necessary to regard them as standing rules rather than as commands to be executed once and for all. We must assume that when one accepts a conditional or a negative sentence, one stores a checking procedure which is then applied every time one considers a change of the model, e.g. when new information is obtained. Of course, the human processing system must have some way of selecting 'relevant' procedures, but in principle I think it is plausible that all new information is checked in this way against the already stored knowledge.

The three categories we have discussed here, yes-no questions, conditional clauses and negated sentences, have several things in common syntactically. For one thing, questions and conditional clauses are very often formed in identical or similar ways in various languages. Also, there are many cases of grammatical elements or lexical items the occurrence of which is restricted to this class of constructions (or to some class including it). One of the better-known cases is that of the so-called rule in English. This rule seems to be related to the function of indefinite noun phrases in the constructions in question. Consider the following sentence.

(5) Someone has stolen my bike.

We said above that (5) is an instruction to introduce into the model an element *x* which is such that *x* stole my bike. But compare now the denial of (5):

(6) No one has stolen my bike.

or an equivalent containing *any*:

(7) My bike has not been stolen by anyone.

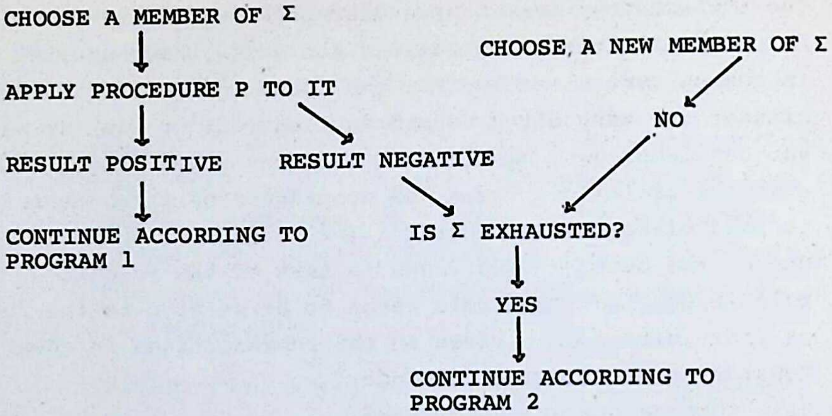
We could of course suggest that (6-7) are prohibitions to introduce elements with the property in question. However, we run into the same difficulty as generally with negated sentences: suppose there already is such an element in the model? If we try to give an account of (6-7) along the lines of (4), what we have to do instead is something like the following: we interpret the sentences as instructions to check the model to see if any proposition of the form 'x has stolen my bike' is true in it, rejecting the model if we find out that at least one is. In other words, the difference between (6) and other negated sentences is that we check a set of propositions rather than one. The same can be applied to the corresponding yes-no questions and conditional clauses:

(8) Has anyone stolen my bike?

(9) If anyone has stolen my bike...

Here we get a more complicated kind of yes-no procedure, where some procedure P is applied to the memebers of some set Σ, until either (a) a positive result is obtained for one of them or (b) the set is exhausted. The diagram that follows illustrates this.

(10)


CHOOSE A MEMBER OF Σ
APPLY PROCEDURE P TO IT
RESULT POSITIVE
RESULT NEGATIVE
CONTINUE ACCORDING TO PROGRAM 1
CHOOSE A NEW MEMBER OF Σ
NO
IS Σ EXHAUSTED?
YES
CONTINUE ACCORDING TO PROGRAM 2

5.6 Hintikka's game-theoretical semantics and constructional vs. truth-conditional semantics. In a number of places, Jaakko Hintikka and his collaborators have put forward a theory of game-theoretical semantics (see for instance Hintikka 1973, 1974) We quote here the summary of this kind of semantics, given in Hintikka and Carlson (forthcoming b):

> 'The semantical properties of a sentence S are determined in game-theoretical semantics by reference to a two-person game G(S)...correlated with S. The players are called Myself and Nature. The game can be looked upon as a stepwise process of verification of S with respect to a given universe of discourse. At each step, a new semtence S' is produced depending on the two players' choices of individuals and of sentences.
>
> The outcome of the game is a sentence to which no further game rule applies. The truth-values of these 'atomic' sentences are assumed to be determined independently. My aim in the game is to have it produce a true atomic sentence while Nature tries to steer the game to a false one.
>
> When the game has reached an atomic sentence, the play of the game has come to an end. The payoffs of the players depend on the truth-value of the outcome as indicated earlier. If the outcome is true, I have won and Nature lost; if it is a false sentence, vice versa'.

Hintikka's game-theoretical semantics can be said to be a direct development of truth-conditional semantics, and it is therefore no accident that what happens here looks much more like our yes-no procedures than our constructional game (cf. the formulation a 'step-wise process of verification of S').[15]

Hintikka's language games can be taken as models of question-answer interactions in natural language: we substitute 'Speaker 1' and 'Speaker 2' for 'Myself' and 'Nature' and stipulate that Speaker 2 marks his losses by 'yes' and his wins by 'no'. (Cf. also a type of real games – quiz games, which differ from the above games essentially in that 'Speaker 2' is without access to the universe of discourse and thus must guess what to answer).

The 'verificational' character of Hintikka's game-theoretical semantics is also reflected in the treatment of existential statements: 'Since the verification of an existential statement requires the searching for and the finding of a suitable individual, these verificational games are essentially games of seeking and (hopefully) finding' (Hintikka 1976). Cf. Hintikka's rule for the interpretation of existential sentences:
'(G.E) If S' is (Ex)F(x), I choose a member of D, give it a name (if it does not have one already that can be used), say 'b'. The game is then continued with respect to F(b)' /i.e. one checks whether this sentence is true or not Ö.D./ (Hintikka 1976). Clearly, this is an account of someone trying to answer an existential question ('Is there an individual such that..?') rather than someone making an existential statement. Only indirectly can we arrive at a characterization of the behavior of the latter. (Cf. 'A first-order sentence becomes, as it were, a kind of prediction of what may happen in the game associated with it' (Hintikka 1973:103).

What I have said here should not be taken as an attempt to show that Hintikka's game-theoretical semantics is misguided. On the contrary, I think that a better understanding of how it is related to a theory of actual linguistic behavior will allow linguists to better appreciate Hintikka's results.

6. VARIOUS PROBLEMS

6.1 Indefinite NPs and direction of fit. We have seen in 5.2 that indefinite noun phrases have different functions in declarative language-games from what they have in language games that involve yes-no procedures. In that section, we mentioned that models of the world can function in two ways depending on the 'direction of fit', whether one tries to make the model fit the world or the world fit the model. We shall now see that the direction of fit has bearing on the function of indefinite noun phrases, too. Consider the two utterances (1-2):

(1) John, peel an apple!

(2) John peeled an apple.

Both (1) and (2) correspond to a model in which John chooses an apple and peels it. The difference is that in (1), John is identical to the addressee, and part of the meaning of (1) is an instruction to the addressee to choose an apple (from the already existing ones), whereas the addressee in (2) has no freedom to make such a choice, since the apple has already been chosen in the actual world. Rather, as we said earlier, the addressee in (2) is instructed to construct a mental object such that it has the properties specified in (2) (being an apple and being peeled by John).

Thus, the role of the indefinite noun phrase in (1) is similar, although not identical, to that of indefinite noun phrases in yes-no procedures. The differences are rather subtle and hard to formulate exactly, but that they are important is suggested by the fact that some or indefinite articles are used in imperatives rather than any, contrary to what one would expect if imperatives were just like yes-no procedures in this respect. Notice however that in Russian, where there are also different series of indefinite pronouns, imperatives go with questions, conditionals and negatives in choosing -nibud' pronouns instead of -to pronouns (Dahl 1970).

The distinction we have been discussing here between indefinite noun phrases that introduce new elements into the model and those that do not is of course not new. At least some of the people who have used the term 'specific' have had such a distinction in mind. With formulations that come close to those we are using here, the distinction was discussed in Karttunen 1969. The account I gave in Dahl 1970 of the concept of specificity can be regarded as an attempt to give a basically syntactic (in the sense of configurational) explanation of the distinction. One of the main reasons that I started thinking about the problems discussed in this paper was that I wondered how the idea of 'introducing new discourse referents' could be integrated into a logical semantics.

6.2 Indefinite NPs and propositional attitudes. The term 'direction of fit' was introduced by Searle 1976 in order to make a distinction between two kinds of speech acts. A fairly natural extension of the concept would be to apply it to so-called propositional attitudes, e.g. beliefs, hopes, wishes and so on. In constructional semantics, sentences which attribute some propositional attitude to an individual would generally be understood as stating something about a model of the world which exists in that individual's mind. Such mental models may however have a quite different status. For instance, we can distinguish the model of the world which the individual holds to be true from the model which he tries to make true in his actions. We can see that these two have different 'directions of fit'. We should now expect that sentences which attribute propositional attitudes with a certain direction of fit should have some similarities with expressions of speech acts with the same direction of fit. Thus, belief sentences should go with declaratives and sentences which concern desires and goals should go with imperatives. Such similarities can indeed be found in many languages, e.g. in the choice of verbal moods, ways of expressing negation and so on. We might also expect to find such similarities in the form of indefinite noun phrases, to the extent that this is correlated with direction of fit. Russian is a case in point. The two series of indefinite pronouns we talked about above show parallel distributions in the constructions in question. Cf.

(2) (a) Kto-to prišel 'Someone came'
+Kto-nibud'

(b) Ja dumaju, čto kto-to prišel 'I think someone came'
+kto-nibud'

(3) (a) Sdelaj čto-nibud'! 'Do something!'
+čto-to!

(b) On chočet, čtoby ty sdelal čto-nibud'
'He wants you to do something'

(c) On chočet, čtoby ty sdelal čto-to
(no ja ne mogu skazat' čto)
'He wants you to do something'
(but I can't tell you what)

The fact that the two kinds of pronouns can be used to distinguish two readings in (3b) but not in (2b) creates a difficulty for theories which try to reduce specificity ambiguities to differences in the scope of logical operators, e.g. Bach 1968, Dahl 1970, Montague 1974. Such theories do not explain why *dumat'* 'think' should behave differently from *chotet'* 'want'. The problem is connected with some other rather tangled questions.

One is what P. Geach 1972:146 calls 'intentional identity'. Suppose, for instance, that I dream on two successive nights about a girl. Is there any sense in which I can claim that I dream about the same girl both times, even if the girl I dreamt about does not correspond to any real girl? Common-sensically, it seems that such a claim makes sense: we are willing to talk about individuals that exist only in fiction or in people's mind in almost the same terms as we talk about real people.

In other words, we want a semantics which allows us to talk about such individuals. Constructional semantics meets this demand: for instance, a sentence which says that a person believes that someone has a certain property is interpreted to mean that in his epistemic model of the world, there is an element with that property.

An epistemic logic of the type given in Hintikka 1969, on the other hand, does not give us such a possibility. The difficulties arising with intentional identity in a system where saying that a person believes *p* means that *p* is true in all possible worlds compatible with his beliefs, can be illustrated with the following example, which is similar to the ones used by Geach in his discussion of the problem:

(11) Bill believes that someone stole his car. He also believes that this person tried to break into his house.

The difficulty is actually the same as that discussed in connection with indefinite reference in 5.2: there is no natural way to express in logical notation that the individual referred to in the second clause is the same as the one referred to in the first.

6.3 Strong and weak entailment. In this section, I shall discuss some problems connected with the idea that model-building programs are applied according to the principle 'If nothing is said to the contrary', which was touched upon in 2.6. Consider a generic statement e.g. (1).

(1) Swedes are introverts.

We would not consider that (1) had been falsified if we found one or two Swedes who were not introverts. This is an intuitive motivation for assuming a principle of the kind mentioned above. However, it follows that the logic of generic statements in natural language must differ in some ways from the logic ordinarily given for universal statements. Thus, the following two formulas in predicate logic are incompatible.

(2) (a) $\underline{\forall x\ (Fx \rightarrow Gx)}$

(b) $\underline{(\sim Fa)\ \wedge\ Ga)}$

(1), on the other hand, is not incompatible - in at least one sense of that word - with (3).

(3) Pelle is a Swede and Pelle is not an introvert.

In order to encompass these facts into a logic, we might suggest introducing two kinds of entailment, which we shall call strong and weak entailment and which we define as follows:

(4) $\underline{p}$ strongly entails $\underline{q}$ iff for every model $\underline{m}$ and every set of propositions Σ, if Σ contains $\underline{p}$ and Σ is true in $\underline{m}$, $\underline{q}$ is true in $\underline{m}$.

(5) $\underline{p}$ weakly entails $\underline{q}$ iff for every model $\underline{m}$ and every set of propositions Σ, if Σ contains $\underline{p}$, Σ is true in $\underline{m}$, and Σ contains no proposition which strongly entails $\underline{\sim q}$, $\underline{q}$ is true in $\underline{m}$.

For instance, (5a) would weakly entail (5b).

(5) (a) Swedes are introverts and Pelle is a Swede
(b) Pelle is an introvert

One might suggest that (1) and (7) differ in that (7) strongly entails what (1) weakly entails. In other words, (8) would strongly entail (5b).

(7) All Swedes are introverts
(8) All Swedes are introverts and Pelle is a Swede

We could introduce the terms 'weak generalization' and 'strong generalization' to distinguish these types of universal statements. Similarly, a statement that some object falls under some concept would weakly but not strongly entail that the object has the properties that characterize the typical instances of that concept. Thus, in a male-dominated society, (9) would weakly entail (10):

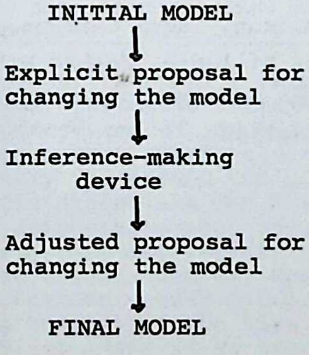
(9) This person is a doctor
(10) This person is male

What we have said here is of some importance for the relations between the concepts 'model' and 'possible world' or 'possible state of affairs'. Usually, these terms are used as if they were equivalent. However, in a system of the type outlined here a model will normally correspond to a set of possible worlds rather than to just one. Suppose we regard a certain relational structure *R* as a model of the world, and that the individual *a* in *R* has the property *P*. Suppose further that having property *P* weakly entails property *Q*, i.e. that individuals which have property *P* typically have property *Q*. In that case, *R* is compatible both with a possible world in which *a* has *P* and one in which *a* does not have *P*. The former world, however, would be the one that we chose if nothing in our model contradicted this choice. We shall say that *R* *suggests* the set of worlds in which *a* has *Q*. We thus distinguish the worlds suggested by a model (or a set of statements) and the worlds compatible with it.

6.4 *Two ways of changing models*. Let us look again at what happens when someone makes a statement. Normally, the participants in the conversation share (or pretend to share) certain assumptions about the world. This set of assumptions embodies the presupposed model of the world for the discourse at that point. The speaker now introduces a proposal for making a change of this model. This proposal may or may not be accepted by the addressee(s), but if they accept it, they may also introduce other changes in the model which are suggested by their general model-building programs and ability to make logical inferences.

Now compare this to what happens in a narrative discourse as defined in 2.3. At each stage of such a discourse, the addressee is invited to imagine a certain model of a situation. The events that are related in the discourse introduce successive changes in the model. The information given in the discourse may be incomplete, so that the addressee is forced to fill in some of the details, making recourse to his general knowledge of such situations as are related.

We see that these two processes are quite parallel. We may represent them both in a diagram of the following kind:


INITIAL MODEL
Explicit proposal for changing the model
Inference-making device
Adjusted proposal for changing the model
FINAL MODEL

By demonstrating this parallelism, we can explain some otherwise perplexing ambiguities in some lexical items in English and other languages. Consider the use of the word *still* in the following discourse fragments:

(1) He has moved to England but his family is still in Sweden.

(2) I have read the book five times. I still do not understand what the author means.

We could suggest the basic meaning of still is to indicate that something is to be kept constant when going from the initial to the final model. Depending on whether we understand the final model as a temporal successor to the initial model or as a better approximation to the correct model of the world, we get the two seemingly different functions of the word: as indicating a continuing state of affairs, as in (1), or as indicating that something contrary to expectation is the case. The word yet works in the same way.

POSTSCRIPT

This paper was originally intended as a revised version of Dahl 1975, but since it is now at least three times as long, such a characterization is hardly adequate. Part of the paper was presented at a colloquium on language-games and game-theoretical semantics held at Uppsala in November, 1976.
I am indebted to the following persons for fruitful discussions and/or comments on earlier versions: Karin Aijmer, Jens Allwood, Lars-Gunnar Andersson, Lauri Carlson, Jerry Edmondson, Jens-Erik Fenstad, Charles Fillmore, Jaakko Hintikka, R.A. Hudson, Jerker Järborg, Esa Saarinen, Sven Öhman.
Sally Boyd corrected my English.

FOOTNOTES

1. The relevant references to Wittgenstein's work are Wittgenstein 1961 for the 'picture'-theory of meaning, and Wittgenstein 1953, 1958 for the concept of a language-game.

2. In Dahl 1975, I used the term 'constructivist', which I avoid here, since it is associated with a particular approach to the philosophy of mathematics which is is not identical - although maybe not incompatible - with what I now prefer to call the 'constructional' approach to meaning.

3. See Wunderlich 1974, Chapter 9.III, for the development of a 'pragmatic meaning concept' building on roughly the same analysis of speech acts.

4. The names of the participants are taken from David Lewis.

5. For further discussion of the treatment of aspect within a constructional semantics, see Dahl & Karlsson 1976.

6. Cf. Forsyth's (1970:10) characterization of perfective verbs in Russian: 'Each perfective verb denotes an action which is a new event, bringing about or at least marking the transition to, a new state of affairs, and thus carrying the narrative forward'.

7. See Chafe 1974 for an attempt to relate the 'given vs. new' distinction to what we know about the organization of human memory.

8. Cf. Öhman 1975 who says that 'a noun such as car, duck, city,etc. represents an incomplete perceptual plan'.

9. The German linguists U. Maas and D. Wunderlich (Wunderlich 1972, Maas-Wunderlich 1972) have made a similar distinction between two kinds of acceptance,one of which they call 'probeweises' Akzeptieren. However, their distinction builds on the question whether one has fully understood the other participant's move or not. 'Sehr häufig akzeptiert der Hörer nur probeweise, was bedeutet, dass er seinerzeits noch spezifizierende Informationen wünscht oder sogar problematisierende Sprechhandlungen beginnt (er verlangt Begründungen), und der Sprecher wird versuchen, hierauf dem Hörer befriedigender Antworten zu geben' (Wunderlich 1972:23). It seems to me that the term 'probeweises Akzeptieren' is misleading here, at least if we try to apply it to the examples I have given in the main text.

10. There may be another, rather marginal, ambiguity in this sentence. Except for the plain prohibitive reading, it might be interpreted in certain contexts as You need not come in, i.e. a permission to refrain from coming in. It is not quite clear how our permission-and-prohibition games can be extended to cover such a case. On the other hand, it is obvious that it cannot be accomodated within the command game either (cf. Rescher 1966^{b}:105).

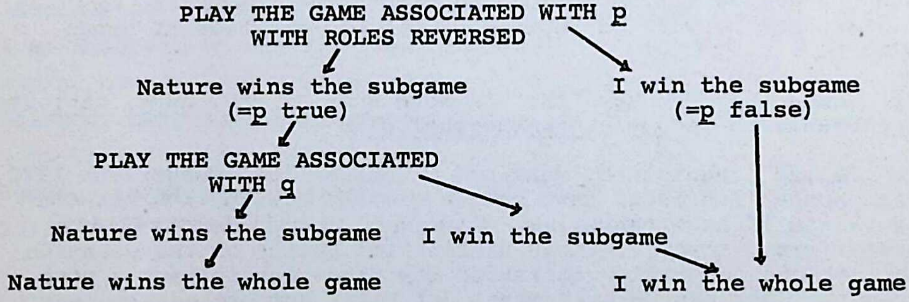
11. In some languages, the different interpretations of imperative sentences are marked morphologically. Thus, commands in Russian generally take the perfective aspect of the verb, whereas permissions take the imperfective aspect. It is noteworthy that prohibitions go with permissions in this respect: negated imperatives are generally imperfective.

12. Some empirical support for such a view may be found in the fact that children tend to use rejection words like no when adult language has a negation.

13. The formulations here are not quite adequate, since they presuppose that the logical operators operate on atomic sentences, which is of course not necessarily the case (although negation in natural language is in fact not naturally applicable to complex sentences). Therefore, a formulation such as 'an instruction to perform the operations specified in the constituent sentence' should rather be re-written as 'an instruction to obey the rules or commands specified in the constituent sentences'.

14. It is instructive to compare (3) to the interpretation rule for conditionals given in Carlson & Hintikka (forthcoming). I have adopted their 'flow chart' in a way which, hopefully, does not misrepresent their ideas but which makes it easier to show the parallels:

Rule for interpreting If p, q:


PLAY THE GAME ASSOCIATED WITH p
WITH ROLES REVERSED
Nature wins the subgame
(=p true)
I win the subgame
(=p false)
PLAY THE GAME ASSOCIATED
WITH q
Nature wins the subgame
I win the subgame
Nature wins the whole game
I win the whole game

We see that the flow charts have very similar structures. However, in our approach, we associate different kinds of 'subgames' with p and q. In the first case, we apply a yes-no procedure, in the second, the operation performed may be of the constructional type.

15. The same applies to the 'PC-game' presented in Hughes & Cresswell 1968:61-2, a kind of logical bingo, where each player raises his hand whenever a sentence which is true in this world (is on his list of sentences) is called.

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CONCRETE SPELLING-OUT RULES IN OPERATIONAL SYNTAX

JERKER JÄRBORG

0 INTRODUCTION

This paper is a more or less final report on one of the versions of formalized syntax emerging out of the Research Project for Logical Grammar. Those interested in the development of this project, are referred to the series Logical Grammar Reports (1972-76, see p. 9). This paper is in most respects identical to Report No. 20 of that series, except for a couple of corrections and additions.[0)]

The grammar developed within the project is known as operational grammar. The reasons for this choice of terminology may be inferred from Dahl 1977a (this volume, p. 71 f). Here, I will content myself with pointing out that the word 'operational' is not to be understood in the same sense as it has in terms like 'operational definitions' etc. The original concept of a grammatical operation has, however, been superseded by that of a matrix (see sections 1 and 2); the remaining operations have been relegated to the morphological component.

The different versions of operational grammar all use an underlying categorial syntactic structure which, in principle, should be easily amenable to semantic interpretation. They differ, however, in the ways and means used to generate surface sentences out of this underlying structure. In the versions proposed by Dahl (cf.Dahl 1977b), the generation of surface forms is supposed to proceed by means of a system of meta-rules and very abstract spelling-out rules, augmented when necessary with rules covering exceptional cases. Such a grammar will, typically, have a compact and elegant system of rules for the syntactic spelling-out, but the actual derivations will tend to become long and complicated. The version proposed below has the opposite properties. Here, the rule system is quite intricate and little use is made of metarules. On the other hand, the actual spelling-out will have a rather transparent character. The essential difference from Dahl's system is thus due to the spelling-out rules, which in my version are very detailed. This difference motivates the title 'concrete spelling-out rules'. It should be stressed that the use of the term 'concrete' does not imply a claim that the rules of my version are based in any way more on linguistic (or psychological) reality than those in Dahl's version. Such claims can, in any case, only be made for grammars explicit enough for empirical testing, something which certainly is not the case for the present grammar

The scope of the paper is limited to what I have called 'higher-level' syntax. By this I mean the syntax of ordinary sentences, down to the level of noun phrases, prepositional phrases, adverbs and so on. The internal structure of such constituents will be neglected, however, unless they contain embedded sentences. Although very little will be said on semantic matters, it should be obvious that semantic considerations have been very important, not the least when postulating underlying categorial structures. The discerning reader may observe that the syntax is not fully neutral with respect to production and perception, as a transformational grammar is supposed to be (cf. the discussion in Chomsky 1965, p.9 and passim). A bias towards a production grammar can indeed be detected and is intentional.

1 THE ORGANIZATION OF THE SYNTAX

All the different versions of operational syntax make use of an underlying level of syntactic representation, known as the *categorial structure*. This is the only level accessible to semantic interpretation. The categorial structure of a sentence consists, in the newer version, of a *list* of the deep syntactic categories making up the sentence, arranged so as to make clear the hierarchical relations between the categories. Many of the instances of the deep categories will also be lexically specified with *lexemes* which thus represent the choice of words in the abstract.

The general format for categorial structures used in this paper will be illustrated by means of an example, which will also be convenient for explaining other general points of theoretical importance.

(1.1) Hypothetical list structure

A1 = B(C2)
C2 = D3(E4)
D3 = $\underline{\text{Lexeme}}_1$
E4 = F5(X(G6), Y(H7))
F5 = $\underline{\text{Lexeme}}_2$
G6 = $\underline{\text{Lexeme}}_3$
H7 = $\underline{\text{Lexeme}}_4$

For obvious reasons the format is known as list structure. The first instance of a category in the list, in this case A1, is an initial symbol; normally, this will of course be S (=sentence). In the first line, the initial symbol is *specified for structure*, as a *matrix* B taking a certain *argument* C2. The matrix B is not further specified. The argument C2, which is also a matrix, is specified for structure in line 2, as a matrix D3, taking a certain argument E4. The matrix D3 is *specified for lexical content* in line 3. The argument E4, which also is a matrix, is specified for structure in line 4, as a matrix F5, taking the X-argument G6 and the Y-argument H7. F5, G6 and H7 are specified for lexical content in lines 5, 6 and 7, respectively.

As the hypothetical example shows, categorial structures consist of three classes of entities: initial symbol(s), matrices and lexemes. A recursive property is gained by allowing initial symbols to fill argument places in matrices. The hierarchical relationships are represented by means of the matrix-and-argument format. Among the matrices two subclasses may be distinguished: matrices that are specified for lexical content (either directly or via other matrices) and matrices that are not so specified. The matrix B in the first line is an example of the latter subclass. The numbers of the category symbols refer to the lines where they are specified, either for structure or for lexical content. As noted in Dahl-Järborg 1975, this type of index is somewhat arbitrary; a stricter system is suggested by Dahl in Part II of the paper. Cf. Dahl 1977b for an elaboration of this. Here, however, the original (and arbitrary) index system is used, mainly because it seems to be easier to write and more compact.

A point to be noted about (1.1) concerns line 4, where a matrix with two arguments appears. The device utilized here will be used in most cases where matrices have more than one argument. The idea is to *mark* the arguments by means of the members of an index set, usually known as the set of *case indices* (NB that 'case' is used in the sense 'deep syntactic case'). Thus, G6 could be called the *X-case argument* of F5. In earlier treatments, the case-markers were strictly indices but there seems to be advantages in handling them as ordinary matrices of the non-lexical subclass. Some matrices take two arguments, neither of which can ever belong to the same category as the other; for those matrices case-marking is superfluous and will not be used.

The categorial structures will not be generated by a set of re-writing rules. Hence, their well-formedness must be guaranteed by other means. For convenience the principal types of rules regulating the categorial structures can be divided into three groups:

(i) General rules of syntactic specification

These rules prescribe what an instance of a given syntactic category may consist of. They are thus reminiscent of the re-writing rules of transformational grammar. A rule underlying (1.1) might be 'a C may consist of a matrix of category D, with one argument of category E'.

(ii) Lexically dependent rules

These rules complement type (i) rules by matching the rules of syntactic specification against the syntactic information given in the lexicon about individual matrices. For (1.1),it may be a general rule which says that a matrix of category F takes one X-argument and one Y-argument but a lexically dependent rule which says that with the F-matrix = Lexeme$_2$, the Y-argument may be of category H.

(iii) List consistency rules

These rules concern the list structure as a whole. The prescribe e.g. that with certain exceptions no symbols may be introduced to the right of the equal sign without being specified at some other place in the list. In (1.1), it is seen that every symbol, except for B, to the right also appears to the left. Rules of type (iii) will also restrict the occurences of zeros and loops in the list structures; a loop (in the sense used here) will occur wherever the same symbol is used in two specifications.

It should be noted that there is no 'generating' going on in any direction in this version of operational syntax. In the preliminary reports, viz. Järborg 1975 and Dahl-Järborg 1975, categorial structures were pictured as representing choices by the (abstract) speaker, proceeding from higher to lower levels. That is, the speaker was seen as choosing an initial symbol, then the structural specification of this symbol, and so on, down to the choice of lexemes. The ordering of the choices was of course not taken to be the real time ordering of actual speech production; rather it was a matter of 'logical' or 'internal' ordering. Nevertheless, experience shows that to talk, however abstractly, about an ordered generation of a sentence is to invite spurious (or perhaps not so spurious) comments on actual production models. Here, the only dimension allowed in the categorial structures will be the natural one of the hierarchy, defined by the matrix-and-argument notation. Thus, no part of a categorial structure will be described as earlier or later than another part. If anything must be said about the speaker's actual 'choices' at this stage, it is that, at the very least, a lexeme AND all the part of the categorial structure relevant for it, must be chosen simultaneously. For our present purposes, and disregarding actual production models, categorial structures should be considered primarily as totalities (as Gestalts, as it were), decomposable into hierarchically ordered parts.

It should be pointed out that the purely syntactic treatment in this paper disregards the most important restrictions on categorial structures: the semantic one. Very many syntactically possible structures will never be produced by the theoretical or actual speaker, simply because their content will be pointless or absurd (which must not be confused with paradoxical or contradictory; such sentences do occur). Semantic restrictions are hard if not impossible to formalize; the important thing here is to realize their existence and to distinguish them clearly from the type (ii) syntactic rules discussed above.1)

The rule system for categorial structures may be regarded as one component of the syntax, where 'component' is not to be understood in the strict, Chomskyan sense. Another component presupposed above is the lexicon. Apart from possible lexical redundancy rules, the lexicon may be thought of as a list of abstract entities (lexemes); these will for convenience be represented by their conventional dictionary form, underlined and with initial capital letters. The lexicon will contain three types of information about each lexeme.

(a) Semantic information, about which very little will be said henceforward.

(b) Syntactic information. This is what is specially referred to in (ii) above. The syntactic information comprises such things as the syntactic category of the lexeme, the syntactic categories of its arguments (if any) and idiosyncratic conditions of various kinds.

(c) Morphological and phonological information. Here, the main expression part of the lexeme, its stem, will be specified (in some phonological representation), together with information about the type of paradigm it follows and any possible irregularities.

Although little will be said about the lexicon in the following section, mainly for the reason that it seems pointless to develop a 'minilexicon' just for the sake of a few examples, it should be kept in mind that the lexical information of type (b) is potentially quite extensive. This is necessary in order that the rules for categorial structures of type (ii) be capable of excluding lexically deviant structures, or, in the terminology of transformational grammar, that over-generation be avoided. When matters concerning the lexicon are touched upon in the discussion, a common-sense approach will be used.

Above I have discussed briefly the elements of the level of underlying syntactic representations. The basic assumption about the surface representations of sentences is that they do not involve any surface structure, in the sense of transformational grammar; i.e. some hierarchical order. Instead, the elements of the surface representations are considered to be ordered along two or three 'surface dimensions'. For Swedish, the main dimensions are the dimension of linear order and the dimension(s) of prosodic features (stress, pitch, duration etc). For other languages (Latin, Swahili ...), the dimension of morphological concord or agreement is fundamental. This dimension provides a set of segmental 'flags', serving, above all, to mark sets of (potentially) non-contiguous words as belonging to the same surface constituent. As is well known, there seems to exist a trading relation between the dimension of linear order and the dimension of morphological marking, as regards their importance for the surface representations: in Sedish, the former is predominant[2)].

A further aspect of our analysis of surface representations in Swedish is that they consist of sequences of main surface constituents. A surface constituent is defined as having exactly one main stress (or some equivalent phonetic device) and possibly, in addition, some morphological agreement feature. The linear order in the surface can then conveniently be described at two levels: the ordering BETWEEN the constituents and the ordering WITHIN the constituents. Regrettably, it is not possible to give a detailed account of the dimensions of prosodic features in this paper, due to insufficient data. It is important to keep in mind, however, that the fairly elaborate system used for describing linear word order actually is insufficient until a corresponding system can be worked out for the prosody. Lacking this, it must be observed that all ordering rules will work for 'normal' prosody only.

The methods of section 3 could probably be extended so as to handle abnormal prosody, like constituents with contrastive stress or extralong duration. In this connexion it is interesting to note that the placing of a constituent first or last in a sentence often seems to have the same function as the use of contrastive stress.

The description model chosen for the ordering between main surface constituents is a *surface canonical form*, inspired by the position frammar of Diderichsen 1966. There is no doubt that a position grammar has many advantages for this kind of task, while its possible disadvantages for describing deeper syntactical relations are of no consequence. The actual canonical form used deviates in many respects from Diderichsen's version. The word order within the surface constituents will be handled by canonical forms of lower rank, insofar as it is relevant to the subject matter of the paper, i.e. higher-level syntax. The surface canonical forms are necessarily language-specific; furthermore they are efficient only for rather analytical languages like Swedish, Danish or, for that matter, English.

The link between categorial structures and surface strings is the set of spelling-out rules. The spelling-out rules of the present version of operational grammar deviate strongly from those of earlier versions, where the spelling out proceeds from the categorial structure over a sequence of intermediate 'preterminal strings'. Here, the categorial structures are spelled out more or less directly by a set of rules which might be called encoding rules. Consider again (1.1). A typical encoding rule might be centered around line 4. The rule might read as follows:

If E is embedded under a D, spell out

a) F by applying morphological operation Oper_I on $\underline{\text{Lexeme}}_2$ and placing the resulting expression in surface position I

b) G by applying morphological operation $Oper_2$/X/ on Lexeme$_3$ and placing the resulting expression in surface position III

c) H by applying morphological operation $Oper_3$/Y/ on Lexeme$_4$ and placing the resulting expression in surface positionII[3)].

A rule such as this will produce the correct order between the main surface constituents, as well as instructions for carrying out certain morphological operations on the lexemes. For cases where the surface constituents are encoded from categorial structure constituents having an internal structure, additional lower-level spelling-out rules are needed. Except for some important cases having to do with embedded structures, lower level spelling out will largely be disregarded in this paper.

To sum up, the present version of operational syntax consists of

A. Rules for categorial structures (divided into the subgroups (i) - (iii) above)

B. The lexicon (containing information of types (a) - (c) above)

C. The surface canonical forms (higher-level and lower-level)

D. Spelling-out rules, or encoding rules (higher-level and lower-level)

E.+F. Morphological and phonological spelling-out rules, not treated here. Cf Källström 1977.

Of these 'components', A will be treated in section 2 and C and D in section 3. Section 4 will contain a number of examples which hopefully will serve to reduce any confusion arising in the earlier sections. Some concluding remarks on the grammar are made in section 5.

2 ON CATEGORIAL STRUCTURES

The categorial structures of operational grammar are set up with two purposes in mind: they should serve as suitable objects for semantic interpretation and they should provide a basis for expressing syntactic relationships between sentences. To some extent, these purposes stand in opposition to a metalinguistic principle (a variant of Occam's razor) which has gained some ground in recent years, namely, the principle of not making the analysis more abstract than the surface phenomena forces us to do. Here, the contradiction has led to a form of categorial structure which is rather 'shallow' (due to the abstractness problem) while being quite diversified (to take care of some rather subtle semantic differences between similar sentences). Consequently, the requirement that an underlying representation be capable of expressing syntactic relationships has been partially neglected. It is not clear that this neglect is really to be regretted. I have argued elsewhere (Järborg 1975) that the notion of syntactic relationship is not nearly as well-defined as one might wish. It seems likely that this notion can be meaningfully discussed only in the wider context of all interrelations between semantics and syntax. I hope to be able to contribute to this discussion in a future, more ambitious paper.

The categorial structures will be presented mainly by means of rules of type (i) of section 1. The actual formulations of the rules have been chosen primarily in the interest of clarity of exposition. This means that brevity of expression and formal rigour have been assigned a low degree of priority. After all, it seems preferable to produce an extensive syntax, even if repetitive and fuzzy in places, than a formally faultless syntax for a tiny fragment of a language.

The initial, or better, top symbol of all categorial structures in this paper will be S, i.e. 'Sentence'. This category covers all ordinary assertive sentences, but does not extend to imperatives or questions. Such sentences will not be treated here, although the framework could certainly accomodate them. It is assumed that imperatives and questions have the top symbols IS and QS, respectively; the specifications of these symbols will be similar but not equal to those of ordinary S's.

The general syntactic specification rule for assertive sentences is

(2.1) S = FIN(PRED)

where FIN is the one-place, lexically unrepresented 'finitization' matrix. The surface mark of FIN will of course be that some verb will take the finite form but there is no lexical ITEM representing FIN; in that respect FIN is thus lexically unrepresented. PRED is some member of the class of *predications*, to be kept apart from the traditional class of predicates. Thus, rule (2.1) says, in effect: a sentence is a *finite predication*. This type of analysis can be found in Järborg 1975, although there, a 'finitization-operation' only appears during the spelling out. In Dahl-Järborg 1975, Dahl uses a finitization matrix in his categorial structures, which seems to be the logical way to proceed.

Rule (2.1) presupposes certain things which are worthy of comment. Firstly, the formulation implies that there is also a category of *infinite* predications; furthermore according to the principle referred to above, such a category ought to be of use in its own right in language description. In Järborg 1975 it was argued that it is indeed meaningful and useful to postulate this category. Cf also Dahl in Dahl-Järborg 1975 for a partially similar view. Secondly, rule (2.1) obviously contradicts the traditional view that a sentence is formed primarily by the joining together of a subject and a predicate. However, given the assumption that there are syntactic entities differing from sentences only by the lack of the feature finitization (sentence-like strings without a finite verb), it follows that the joining of subject and predicate cannot, in any case, be the HIGHEST of the sentence-specifying matrices. Below, it will be argued that the traditional notions of subject and predicate are inadequate in certain other respects as well. Thirdly, it may legitimately be asked what is the MEANING of the matrix FIN, bearing in mind that all and only the matrices in the categorial structure should be subject to semantic interpretation. This point was discussed at some length in Järborg 1975, although the terminology and metaphors were not quite adequate. I will not reproduce that discussion here, but I will try to improve on the metaphors. My assumption is that an infinite predication stands in the same relation to a finite predication (a sentence) as a common noun phrase to a quantified or definite noun phrase. FIN would thus correspond, more or less, to a quantifier or a determiner. An alternative proposal[4], that FIN should be interpreted as the extralinguistic 'act of assertion', I find quite unenlightening, in a linguistic context.

Besides rule (2.1), there is an optional matrix for sentences taking sentences as arguments.

(2.2) S_i= ANT/X/(S_j) optionally,
where X is an argument (or the main part of an argument) out of the syntactic specification of S_j.

Restriction: S_j may not be ANT/Y/(S_k). S_i must be the top symbol of the list structure (or, possibly, S_i may be embedded under a 'verb of saying')[5].

The matrix ANT is a special type of one-place matrix, since it also takes a 'parameter' which is a *part* of the argument. The surface mark of this matrix is that the expression deriving from X will occupy the first position of the surface sentence (ANT is supposed to suggest 'anterior'; no phonological associations intended). The phenomenon in question is generally known as topicalization and is called so in other versions of operational syntax. The change in terminology here is due to the fact that the fronted constituent in the great majority of cases is simply not the topic, in any reasonable sense of the word. Indeed, the fronted constituent could usually be characterized as the *focus*, which is certainly very far from the topic. (For a discussion of these matters, including the distinction 'topic-focus', cf Dahl 1974). Thus I conclude that the traditional terminology is misleading, to say the least. Furthermore, the syntactic device of changing the surface order between constituents is in actual speech intimately connected with changes in the prosodic features. If it were possible to include these features in the syntax, different forms of constituent fronting might be distinguished (some of which might actually be true topicalization); as this is not the case, it seems preferable to have a neutral terminology for the syntactic device of fronting.

For some of the following rules there will be restrictions of the type occuring in (2.2). The notions of argument and main part of the argument will be explicated below.

The category of predications (which may be thought of as protosentences) is divided into two distinct classes: *categorical* predications and *thetic* predications. (The terminology gives rise to an unfortunate near-homonymy between the concenpts of categorial structures and categorical predications which, however, is more harmful in theory than in use). The terms have been used in various ways in earlier versions of operational grammar, deriving originally from Kuroda 1972. We will represent the two classes by the symbols CAT ('categorical') and THS ('thetic'). In the actual list structures one line will be saved by never using the symbol PRED; either CAT of THS will

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be used directly, in specifications emanating from rules like (2.1). PRED will only be used in rule-writing as a cover symbol, a device which proves to be convenient for a great many other categories as well.

The distinction between categorical and theitic concerns an intuitive classification of sentences into two groups: those which are satisfatorily described by the traditional logical bipartition into subject and predicate (signifying an 'object' and a 'property', respectively) and those which are not so describable. The first class typically comprises copula-and-predicative constructions, the second class sentences with so-called formal subjects and probably sentences with transitive verbs and several objects. Consider:

(2.3) Snow is white.

(2.4) Peter bought his wife a mink cape from a fence for two hundred dollars.

The 'logical' paraphrases of these sentences might be:

(2.3') Snow has the property of being white.

(2.4') Peter had the property of buying his wife a mink cape from a fence for two hundred dollars.

I believe that most people (outside the ranks of logicians) would consider (2.3') a plausible paraphrase of (2.3) and (2.4') a distinctly odd and rather infelicious paraphrase of (2.4). However, there are even clearer examples. Consider:

(2.5) There is a man loitering in the alley.

A 'logical' paraphrase of (2.5) (there has the property of??) would be absurd. Thus, the distinction seems to be founded in reality, although one might still argue that it is semantic rather than syntactic. Suppose, for the sake of argument, that the distinction categorical-thetic is partially syntactically represented. The question about the extension of the two classes will then have to be considered. The answer will be very dependent on one's views on topic-comment (or 'theme-rheme') structure and its manifestations. In Dahl-Järborg-Källström 1974 a clear belief in topic-comment structure as a prominent feature of Swedish syntax was presented and this point of view is reflected in the choice of categorial structures for sentences with ordinary (i.e. non-copulative) verbs: they can be either categorial or thetic. In Dahl-Järborg 1975 and Dahl 1977b Dahl goes a step further and regards most sentences as primarily containing a topic-comment structure, with the sole exception of sentences of type (2.5), i.e. those with formal subjects. In Järborg 1975, on the other hand, categorical predications are used mainly for sentences with copulative verbs. Here, I will take the position that Swedish, in contrast to languages like Japanese (and probably Russian, cf.Dahl 1969) makes no general syntactic use of topic-comment structure[6]. Hence I will use categorical predications only for their obvious purpose, namely for sentences with copulative verbs. All other verbs must be dominated by thetic predications. I will return to the semantic implications of this position presently.

Categorical predications are specified according to the simple rule

(2.6) $\mathrm{CAT{=}(THM,RHM,\ (M{:}b(W)_0^n,\ (M{:}l(W)_0^n)}$

where the obligatory arguments TMH and RHM are the category symbols for theme and rheme, respectively. The optional argument(s) M:b(W), M:l(W) will be discussed at some length below.

This rule assumes a 'null-matrix' for categorical predications, taking two obligatory arguments. In Dahl's latest writings a matrix NEX, for 'nexus' is used in similar contexts. However, since the function of such a matrix can only be the abstract 'joining' of the two arguments, it seems superfluous to invent a name and a category symbol for it. The obligatory arguments of this null-matrix are not furnished with indices of the kind discussed in section 1; this omission is permissible because the categories THM and RHM can only arise as a PAIR from the specification CAT; moreover, they are quite dissimilar in internal structure.

For the further specification of categorial predications, the following rules are needed:

(2.7) THM = A

where A is a cover symbol, mainly for noun phrases (NP).

(2.8) $\text{RHM} = \text{VB}(Z, \quad (M{:}b(W)_0^n)$

Restriction: The main verb (see below) in the specification of VB must belong to the class {Vara, Bliva, Varda, Förbliva, Heta, Kallas} 'be', 'become', 'become' (archaic), 'stay', 'have the name', 'be called' or else it must be Ø.7)

(2.9) Z=ADJP or NP or PP or ADV

where the symbols stand for adjectical phrase, noun phrase, prepositional phrase and adverb, respectively. In rule (2.8) Z is a cover symbol for the predicative complement. It will never appear in actual list structures.

There are several restrictions on the permissible combinations of VB and Z, most of which concern lexical subgroups. The full range of Z may occur only with the verb Vara 'be', although marginally some ADV's (and PP's) may occur with Bliva, Varda, Förbliva. The verbs Heta, Kallas are restricted to very limited types of Z (basically only NP= CN or PN - common noun or proper noun - and ADJP = ADJ - adjective). The zero verb in (2.8) may occur only marginally in the structural context S=FIN(CAT);

CAT= (THM, RHM) in Swedish. It appears to be more frequent in English, especially in questions in so-called non-standard dialects. There are, however, other contexts where the zero verb will seem a natural solution; in such cases, it will accept most, if not all, of the range of Z.

As is clear from this discussion, many of the finer points concerning pairs of VB and Z are strongly dependent on the choice of actual lexemes. According to the systematics of section 1, such restrictions should be considered type (ii) rules, rather than restrictions on type (i) rules. In the absence of a lexicon, this sort of rules will be presupposed in most cases. The demarcation between type (i) and (ii) rules, being mainly a theoretical artifact, will in cases like (2.8), (2.9) be treated with common sense methods.

The main rule of syntactic specification for thetic predications is

(2.10) $\mathrm{THS=VB(SB,\ CP,\ (M{:}b(W)_0^n,\ (M{:}l(W)_0^n)}$

where the main verb in the specification of VB is any verb not in the set given in (2.8), SB is the symbol for 'subject' and CP the symbol for 'complement', to be specified in rule (2.12). This last symbol is mainly for convenience in rule-writing, to avoid nested bracketing.

(2.11) SB= A

(2.12) $\mathrm{CP=\ (PS(A_i),\ IO(A_j),\ DO(A_k),\ PREP_x(A_m),..\ PREP_y(A_n),\ (M{:}b(W)_0^n)}$

where PS, IO and DO stand for 'primary subject', 'indirect object' and 'direct object', respectively. PREP is of course preposition; thus, $\mathrm{PREP_x(A_m)}$ stands for a prepositional argument. All the members of CP are optional in principle. In the structural contexts S=FIN(THS), SB= THS and VB(.. DO(THS) ..) the argument SB is obligatory for the THS. In other contexts, SB must be $\emptyset$. Any further restrictions on the set of arguments, CP, are strongly dependent on the VB chosen. In the lexicon, each verb must be provided with syntactic information about which types of arguments are obligatory and optional for that verb. A verb like Köpa 'buy' would thus be marked as taking one (more or less) obligatory DO argument and optionally either a IO argument or a Åt (or Till)'for' argument, besides the further optional För 'for' and Av (or Från) 'from' arguments. Each of these arguments of Köpa will have a semantic interpretation that is, in principle, unique for this verb. There are also prepositional arguments which may optionally be added to almost any non-categoric verb. Notable among these are agentive (av, 'by') arguments, which are optional for all passive verbs, instrumental (med 'with') arguments and benefactory (för 'for') arguments.

A small class of verbs take PS arguments in the complement phrase. These verbs are typically intransitive and have locative meanings. Even so, two conditions must be satisfied: the SB argument must be filled with Det 'it' or 'there' (the formal subject) and the PS argument must be filled with an indeterminate noun-phrase. (Cf Dahl-Järborg-Källström 1974, Dahl-Järborg 1975, and Dahl 1977b).

The analysis of optional arguments presented here is similar to that given in part I of Dahl-Järborg 1975. A crucial question arising from this type of treatment is whether the undoubted semantic differences between 'extra arguments' and prepositional phrases used as adverbials has any syntactic correlates, which would justify the different sources for these constituents in the categorial structures. In my opinion there is at least one subtle syntactic difference: the prepositional argument may be subject to fronting (i.e. being X in (2.2)) either with or without the preposition, while other prepositional phrases may not be split in that way. Consequently, some terminology is needed in order to handle this difference in the spelling-out rules. By a (full) *argument* of a verb I will means the WHOLE category expression, e.g. SB, DO(A_k), PREP$_x$(A_m) etc. By the *main part* of an argument I will mean the corresponding A only: thus A_k or A_m are main parts of arguments. The terminology is hardly elegant but will do for the present purposes.

At this stage I want to return to the distinction I have made between categorical and thetic predications. As is seen from rules (2.6) - (2.8) and (2.10) - (2.12) the basic structural difference is that on the one hand a categorical predication is considered to be a *relation* holding between two equally important entities. On the other hand a thetic predication is considered to consist primarily of ONE entity, the verb, which is generally modified in various respects by entities of lower rank, the arguments, which in turn are not of equal rank, the SB argument being the highest-ranking one. Now, what semantic implications do these structural differences have? As I do not want to treat semantic questions in any great depth, the best I can offer is a vague, but, hopefully, intuitively understandable notion of 'semantic load'. The structure of a categorical predication implies that the main semantic load (of the corresponding sentence) is carried by both the main constituents together. The structure of a thetic predication implies that the main semantic load is carried by ONE constituent, the (main) verb; the next heaviest load being carried by the SB argument and after that, the various other arguments and modifiers in turn. These structural assumptions suggest that a categorical sentence would not lose much in informational content if the verb were left out, while becoming rather pointless if the theme (the surface subject) OR the rheme (the predicative complement) were excluded[8]. On the other hand, a thetic sentence without the (main) verb would be totally incomprehensible. As far as these rather vague observations go, it seems as if there is some justification for my decision to distinguish between categorical and thetic predications in the way I have done.

We will now turn to the mystifying arguments M:b(W) appearing in the rules (2.6), (2.8), (2.10) and (2.12). All the 'M's' in these rules can be of any number, from zero up. The letter M is supposed to suggest 'modifier'. The distinction between M:b and M:l is introduced to handle certain surface ordering problems. The distinction will often tend to coincide with the distinction between adverb and adverbial and the symbols chosen are supposed to suggest this. Semantically, an M:b will tend to modify the state, change, action etc. in itself; an M:l will tend to modify the circumstances around it. Unfortunately, I am unable to provide handier names for these subcategories of modifiers. It is seen in the rules that the modifiers are introduced at two levels: as a direct specification of the predication, in (2.6) and (2.10) and as a specification on a lower level, in (2.8) and (2.12). Adverbs introduced at the higher level are so-called sentence adverbs, like negation, while at the lower level such things as adverbs derived from adjectives will appear. Semantically, a higher-level adverb will tend to modify the predication as a whole, a lower level adverb will tend to modify the verb directly. So-called speech-act adverbials (cf for instance Andersson 1975) will not be treated here but it is possible that they would demand yet another level for their introduction.

The important difference in my system between the 'M' arguments and prepositional arguments is that the 'M' symbol is just a marker for modifiers and is neither lexically specified, nor encoded as an instruction to perform some morphological operation. Therefore, there can be no distinction between the full argument and the main part of an argument, as was the case for prepositional arguments. The W of an 'M' argument can thus never be the X of rule (2.2), which is another way of saying that adverbials may not be split by fronting.

The argument W of an 'M' is a cover symbol which can be specified by the following rule:

(2.13) W=ADV or PP (or A)

if M:b(W), M:l(W) are in the specification of PRED or CP, where ADV is adverb and PP is prepositional phrase. The possibility W=A, where A is as in (2.7) etc. is kept open for odd cases of embedded sentences. Ordinary adverbial sentences are introduced by way of the PP; cf (2.21).

The question of surface order among adverbs and adverbials is of forbidding complexity. By separating two levels for the introduction of modifiers, some measures are taken for the differentiation between modifier expressions in the spelling-out rules. However, this step is not sufficient, at least not if one is reluctant to assign any remaining variability in surface order to free (and, presumably, semantically neutral) variation. The picture would, of course, be more complicated still, were the prosodic features included in the surface representations. To improve matters a little, I will introduce two further devices for handling the remaining ordering problems. Firstly, it seems that for structures with several modifiers on the same level and of the same type, what is needed is a simple numerical ordering of the modifiers. Consider

(2.14) Pelle arbetar i garaget på söndag.
'P. works in the garage on Sunday'

which would have the categorial structure (heavily abbreviated)

(2.14') S1=FIN(THS2)
THS2=VB3(SB4, CP5, M:1(PP6), M:1(PP7))
VB3=Arbeta
SB4=NP8 (= Pelle)
CP5=Ø
PP6=PREP9(NP10) (=i garaget)
PP7=PREP11(NP12) (=på söndag)

The problem here may not be obvious until one realises that, according to the general conventions of operational grammar, there should be no significance in the ordering of the arguments at any given level: PP6 and PP7 might equally well have the opposite order. This being so, the problem is simply how to ensure that (2.14') is spelled out as (2.14), and not in the other possible way (på söndag i garaget). There are two simple solutions: either to introduce a special index of order for modifiers (say $M:l_1(PP6)$, $M:l_2(PP7)$) or to let the already existing numerical indices HAVE significance WITHIN the classes of modifiers. I will use the second alternative here, as it makes the list structures slightly more readable. The same device can be used for the ordering between prepositional arguments as well as for other types of arguments with no naturally differentiating indices.

Secondly, it seems that modifiers which intuitively are 'close' to the meaning of the verb and hence will originate in the lower levels (by (2.8) and (2.12)) sometimes will behave deviantly in the surface representations. For such cases I will introduce the symbol mM:b, to be read as *minor modifier*. The term is supposed to suggest that such modifiers have less semantic weight, which is reflected in the surface by loss of stress compared with the normal case. This device will be used for non-prepositional arguments as well; i.e. some list structures will contain category expressions like mDO(NP). As the theory for noun phrases and pronouns is far from ready, I shall content myself with suggesting that a minor argument almost always is a personal pronoun and almost never a full noun phrase, especially not a 'long' noun phrase. Conversely, almost all occurences of personal pronouns should probably be considered minor arguments. For the difference in surface behaviour between ordinary and minor arguments, cf. section 3 and example (4.10). Incidentally it seems that sentences with IO as a full noun phrase and DO as a personal pronoun are usually not quite acceptable; for this pecularity, I have no explanation to offer.

After this survey of the main rules of syntactic specification, some of the principal categories used in the rules above must be discussed. Embedded sentences and sentence-like structures will also be touched upon in this connexion. We will begin with rules for the specification of the unanalyzed VB of the rules above.

(2.15) Either (i) VBa = PAST (VBx)
or (ii) VBa = VBb(SUP(VBx))
(iii) VBb = PAST(VBc)

where PAST is the preterite matrix and SUP the supine matrix. Each step of the rule is optional.

Restriction: VBb, VBc=Hava 'have'[9)]
N.b. For a VBa that is not the verb of a PRED in the structural context S= FIN(PRED), only step (ii) is applicable. This is a syntactic restriction of Swedish that need not hold for other languages; thus Latin is said to possess a past infinitive.

The actual conditions of use for past tense, perfect and past perfect, (i), (ii) and (iii) respectively, are a matter for the semantic 'component' and are thus outside the scope of this paper. The rule only allows for two-verb constructions with the supine as the second form; for other types of surface verb constellations, also involving infinitives, see section 4, especially the comment to example (4.8).

At this point it is useful to introduce some terminology for verbs. We will refer to the unanalyzed category symbol, appearing in rules (2.8) and (2.10) and as VBa in (2.15), as the *total verb* of the predication. The symbol VBx in (2.15) (i) and (ii) will be known as the *main verb* of the predication. VBb of (ii), or, if (iii) has applied, then VBc will be known as the *auxiliary*. Since, in our formalism, it is the total verb that takes the arguments, we must state the rather obvious convention that the total verb derives all its lexically dependent syntactic properties from the corresponding main verb.

In this connexion the passive matrix, PASS, must be mentioned. PASS is a matrix for main verbs, taking main verbs as arguments; thus in the notation of (2.15), VBa or VBx may be =PASS(VBy). This formula is not allowed a rule of its own, since it appears to belong to the border area between syntax and lexicon. From a morphological point of view, it would be preferable with structures like PASS(PAST(VBy)) instead of those produced by (2.15) since that would correspond closer to the surface forms (e.g. kasta+de+s 'throw' + PAST + PASS). This is just an esthetic defect, to be rectified by the morphological component. The function of PASS is, to elaborate on a suggestion in Järborg 1975, to DELETE one obligatory argument ≠ SB from the 'case-frame' of the original verb. This is done by prescribing that the main part of the argument to be deleted be specified as Ø. Thus, if the verb Slå 'hit' has the case-frame (SB, (DO)) and the verb Lita 'trust' has the case-frame (SB, (På)) we would get the following partial list structures for the sentences

(2.16) Pelle slås.
'P. is being hit'

(2.17) Pelle litas på[10].
'P. is being trusted in'

(2.16') S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=PASS(VB6)
SB4=Pelle (simplification)
CP5=DO (Ø)
VB6=Slå

2.17') S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=PASS(VB6)
SB4=Pelle (simplification)
CP5=PREP7(Ø)
VB6=Lita
PREP7=På

The point is now that the fifth lines of these structures easily allow spelling-out rules to be formulated making DO(Ø) = Ø while leaving the preposition På intact.

For verbs having more than one obligatory argument in the CP, there are, properly, several PASS matrices. For separating them the parameter notation may be used. Thus, for the verb Giva 'give' there are a) PASS/IO/(Giva) and b) PASS/DO/(Giva), corresponding to

(2.18) a) Pelle gavs en bok.
'P. was given a book'

b) En bok gavs Pelle.
'A book was given to P' , respectively.

Next, we turn to the cover symbol A out of the main syntactic specification rules. Normally, A is a noun phrase but it can also be other things.

(2.19) A= NP or NOM(S) or NOM(PRED)
OR=PRED iff A is a SB or DO argument to certain verbs, where NOM is the nominalization matrix (generally represented in the surface by att 'that', 'to').

As is clear from the formulation of (2.19), I do not wish to make att-clauses fully equivalent to ordinary noun phrases, although the similarities are certainly great. The category NOM(PRED) stands for infinitival expressions. The NOM matrix is restricted to predications where THM or SB = Ø. For the use of PRED as an argument (without NOM), the reader is referred to Järborg 1975, where, in particular, the accusative-with-infinitive construction is treated in some detail. Needless to say, there are several subtle restrictions on the use of the various A categories. Rule (2.19) is the most important embedding rule in this version of operational syntax.

For adjectival phrases, ADJP, out of rule (2.9), there must be a rule similar to (2.10) and (2.12).

(2.20) $\mathrm{ADJP{=}ADJ(IO(NP),\ DO(NOM(PRED)),\ PREP}_x(\mathrm{A}_m),\ .\ .\ \mathrm{PREP}_y(\mathrm{A}_n),$
$\mathrm{(M{:}l(W))}_0^n)$

where all arguments are optional.

Here, it seems that, except for IO, all the arguments must be ordered. It also seems that the operator m (minor) discussed above will be handy, although it is hardly applicable for the DO, nor for any $\mathrm{PREP}_x\mathrm{(A)}$ if A=NOM(S) or NOM(PRED). The modifiers M:l are reserved for rather special cases; the usual modifiers of adjectives, i.e. adverbs, will be introduced at a lower level by some rule such as $\mathrm{ADJa{=}ADJb(M{:}b(W)}_0^n)$.

Rule (2.20) reflects the view that it is normal for adjectives to take various types of complements. The IO argument is possible for a few adjectives, but the resulting sentences sound rather out-of-date, as can be seen in (4.9). The index DO for what will be the infinitival complement of the adjective may seem weakly motivated. However, in this syntax, as in many others, DO is the unmarked argument and as it has a similar use in the specifications of theses, it seems the natural choice, always supposing that one wants to avoid having to invent new case indices.

The specification of noun phrases lies outside the scope of this paper, besides being at present insufficiently studied. It seems, though, that a specification along lines of (2.10), (2.12) and (2.20) has much promise for common noun phrases (CNP), i.e. noun phrases without any quantifiers or determiners. Some nouns certainly take prepositional arguments and/or infinitival complements, if not obligatorily, then at least very naturally. The modifier apparatus, with suitable adjustments, should be able to handle adjectives, prepositional attributes and possibly non-restrictive relative clauses. It is anticipated that restrictive relative clauses need a separate approach.

Finally, we will consider prepositional phrases as emananting from (2.13):

(2.21) PP=PREP(A)
Condition: PP is an 'M' argument.

By this rule, another important source for embedded sentences is covered. Rule (2.21) is responsible for one of the great differences between Swedish and English, as that- clauses cannot generally be preceded by prepositions in modern English, something that is perfectly grammatical for att-clauses in Swedish. Properly, (2.21) needs to be complemented with

(2.21') PP=SUBC(S)

where SUBC is an improvised symbol for subordinating conjunction. This rule has not been worked into the syntax as present, but it would be no great task to do so.

This survey should cover all the main rules of syntactic specification necessary to follow the examples in section 4. As previously noted, the lexically dependent rules for categorial structures must be left largely to common sense. Going on to the list consistency rules, these are in a way pointless in a paper restricted to higher-level syntax. However, at least the following, very general principles should hold in an elaborated version with complete list structures:

(2.22) a) All symbols which have appeared as part of a specification MUST be specified, unless they are members if the class of lexically unrepresented matrices ('grammatical matrices', such as FIN, PAST etc; basically a finite class).

b) An individual symbol may be used only once in a full specification, but any number of times as a parameter.

c) Zeroes representing obligatory matrices are restricted to cases expressly mentioned in the syntactic specification rules.

3 ENCODING INTO SURFACE STRINGS

In this section, the surface canonical forms referred to in section 1 will be given first, as a necessary prerequisite for the discussion of the spelling-out rules. It is assumed that surface strings are most naturally described at two levels: the level of main surface constituents and the level of surface words. These levels will be known, informally, as the higher and lower (surface) level. For both levels there is a set of canonical forms regulating the linear order of the elements. As this paper concerns higher-level syntax, the lower-level canonical forms will be treated more briefly, with one important exception.

Although more or less the same terms will be used for the surface constituents as were used for the categories in section 2, it is important to remember that this terminological similarity makes no claim IN PRINCIPLE about the spelling out. In other words, the NAMES of the surface constituents must not be considered a sort of spelling-out rules. It is nevertheless true that very often the spelling-out rules will in practice result in a deep category being expressed by a similarly named surface category. This phenomenon is merely of mnemonic value.

The basic higher-level canonical form is given in (3.1); it will be referred to in most spelling-out rules in what follows. The central position of this rule is especially evident at the present stage, where no imperatives or questions have been included in the syntax. These might need a surface canonical form of their own, or they might be accomodated within the very comprehensive (3.1).

(3.1) The surface form of PRED

Position 0: Conjunction/Subordinating Conjunction/Complementizer
-"- 1: Anterior Phrase
-"- 2: First Verb Phrase
-"- 3: First Argument
-"- 4: Main Verb Phrase
-"- 5: Second Argument
-"- 6: Third Argument
-"- 7: Adverb(s)
-"- 8: Prepositional Argument(s)
-"- 9: Adverbial(s) and/or Final Argument

In Swedish assertive sentences, positions 1 and 2 are obligatorily filled; the others are optional. (This is meant as an informative remark, not as a spelling-out rule).

It is relatively easy to construct sentences with any or all of the eight optional positions filled, but it is not very enlightening. Of more interest is the fact that (3.1) would seem to allow just one place for adverbs, thereby severely restricting their occurence. The explanation of this apparent deficiency will be given later in this section. An explanation of the Final Argument position is also needed: there are, after all, no verbs taking four non-prepositional arguments in Swedish. The reason is implicit in the spelling-out rules for thetic predications. In other respects, (3.1) seems to be non-controversial.

(3.2) The surface form of ADJP

Position 1: Front Argument(s)
-"- 2: Adjective Phrase Proper
-"- 3: Final Argument(s)

Position 2 is of course the only obligatory one. The Front Argument position may look a trifle strange, but it has its uses, as will be seen for example in (4.9). For the surface forms of NP, a similar form is assumed; but since the syntactic specification rules for noun phrases are not completed, the NP canonical form may not be definite. However, it seems preferable to give some indication of how the surface form of this important category should be handled.

(3.3) The surface form of NP
Position 1: Front Argument(s)
-"- 2: Determiner/Quantifier
-"- 3: Common Noun Phrase Proper
-"- 4: Prepositional Attribute(s) and/or Final Argument(s)

Position 3 is obligatory. The obligatory positions in the last two forms are supposed to be filled with the 'main word' and its closest modifying words i.e. the adjective with adverb(s) and the noun with adjective(s), respectively. The word-order within these constituents will be governed by lower-level canonical forms, which will not be given in this paper. In this particular case, it seems that the same lower-level form may do very well for both these constituents, if a little care is taken with the formulation.

At this stage it is necessary to consider a formal problem. Suppose that a deep category (an S, say) is to be spelled out by means of the ordered string of surface constituents.

(3.4) $A^\frown B^\frown C^\frown D$

where the order is prescribed by a canonical form like (3.1). Supposed further that the part of the categorial structure underlying C sould be spelled out by the string of surface constituents

(3.5) $E^\frown F^\frown G$

The relation between (3.4) and (3.5) as well as the status of (3.4) are not formally well-defined. The problem is that C in (3.4) is NOT an ordinary surface constituent, awaiting the application of lower-level spelling-out rules and lower-level canonical forms in order to be made into a string of words. Instead, it is a quasi-constituent, containing, at the time of the formation of (3.4), parts of the categorial structure not yet spelled out in surface constituents. The first question is whether such entities as (3.4) should be allowed in the syntax at all. It seems that the alternative would be to have a very large set of surface canonical forms, like (3.1), only more complex, to handle every conceivable type of embedding. Since this is hardly practical (especially as the set would probably be infinite), we must take a fresh look at the spelling-out procedure, in order to clarify the status of strings like (3.4) and the entities like C in it. By the principle of top-to-bottom spelling out, some fairly high level (in practical cases, the highest PRED) of the categorial structure underlying (3.4) will be encoded in surface constituents; thus we get A, B, D. But we also get C, which is not in the form of a surface constituent and will not be in that form until some lower level in the categorial structure has been reached by the spelling-out-procedure. It is, however, at the higher stage that the surface constituent A, B, D must be ordered, internally as well as with respect to the quasi-constituent C. Accordingly, we stipulate that a higher-level canonical form may be filled with quasi-constituents as well as with ordinary surface constituents. Thus, the first stage of the spelling out will produce the revised string (3.4'), where the status of C is indicated by placing it within quotes:

(3.4') $A^\frown B^\frown \text{'}C\text{'}^\frown D$

The further spelling out will then, referring to (3.5), produce:

(3.6) $A^\frown B^\frown E^\frown F^\frown G^\frown D$

where all entities are real surface constituents, to be further spelled out by words. It should be specially pointed out that no bracket system or other equivalent mark of subordination or embedding is assumed in the string (3.6): all surface constituents are equally valued. Any surface mark of subordination must be explicitly mentioned in the categorial structure and/ or the spelling-out rules.

We will now turn to the lower-level canonical forms. Most of the positions mentioned in (3.1) - (3.3) can be filled with several words and it is the function of the lower-level canonical forms to order the words within such positions. Generally speaking, lower-level spelling out lies outside the scope of this paper, which for these rules is no great loss, as the surface ordering is mostly very straightforward. Thus, it is well known that in Swedish the adjective precedes the noun in a common noun phrase, that the preposition precedes its noun phrase in a prepositional phrase etc. There are, however, two surface constituents of (3.1) requiring treatment, viz. the First verb phrase and the Main verb phrase (positions 2 and 4, respectively).

(3.7) The First verb phrase in main clauses

Position	1:	First Verb
-"-	2:	Enclitic Argument(s)[11]
-"-	3:	Adverb(s)

(3.8) The First verb phrase elsewhere

Position	1:	Adverb(s)
-"-	2:	First Verb

(3.9) The Main verb phrase

Position	1:	Adverb(s)
-"-	2:	Main Verb

In all three cases, only the verb is obligatory[12].

The notion of a main clause is implicit in the rules for syntactic specification; it is in any case easily expressed formally, as in rule (3.21). The pair (3.7) and (3.8) are responsible for the most characteristic surface difference between main clauses and subclauses in Swedish. In a transformational-grammar framework, the order of (3.8) is generally considered primary and the main clause order is transformationally derived. (Cf. Andersson 1975). Within the present framework a similar conclusion seems to force itself upon us by the formulation of (3.8) and by the existence of (3.9).

Any ordering problems within the surface verb phrases not resolved by (3.7) - (3.9) are, for the time being, to be handled by analogical application of (3.1). It remains to be seen how far this idea of analogical application can be used but it is certainly attractive to have the higher-level ordering rules handling the lower-level order as far as possible. See example (4.10) below.

We are now ready for the spelling-out rules proper, the encoding rules. They will be presented in the logical order, mainly from top to bottom, and in the general format suggested in section 1: that is, 'in the structural context A, perform the operation *0* on lexeme B and put the resulting expression in position n of canonical form F'. The format will not be strictly adhered to, however.

(3.10) The encoding of FIN

If S=FIN(PRED) and VBa is the total verb of PRED, encode

FIN(PRED) as *Fin*($\underline{\text{expression}}_x$)

where *Fin* is the morphological finitization operation and $\underline{\text{expression}}_x$ derives from the further spelling out of the auxiliary of VBa, if there is one, otherwise from the main verb.

This rule anticipates that the surface form $\underline{\text{expression}}_x$ will be used in later encoding rules; when this happens, $\underline{\text{expression}}_x$ in addition to other possible morphological operations must also undergo the finitization operation. (3.10) has thus a 'delayed action', something which also holds for the following rule.

(3.11) The encoding of ANT/X/

If S_i = ANT/X/(S_j) and S_j = FIN(PREDa) and X is an argument or main part of one in PREDy, where PREDy is embedded under PREDa, encode

ANT/X/(S_j) by placing the expression *Oper* ($\underline{\text{expression}}_x$) resulting from the encoding of X in PREDy, in the Anterior Phrase (position 1 in (3.1)) in the spelling out of PREDa.

The notion of embedding is implicit in the rules for syntactic specification. For the purposes of this rule, PREDa is considered to be embedded under itself. *Oper* is some morphological operation, for example one of those presented below.

Obviously, rule (3.11) will provide exceptions for all encoding rules for arguments. It seems preferable to state this as a general exception rule:

(3.12) Corollary to encoding of ANT/X/

All placement instructions in encoding rules for arguments are subject to the restriction that the argument in question is not X of ANT/X/.

The rules (3.11) and (3.12) toghether should guarantee that the fronted constituent receives the correct morphological form, while being placed, unambiguously, in sentence-initial position.

(3.13) The encoding of CAT

a) If CAT is not SB or DO of a THS, encode

the THM as ($\underline{\text{expression}}_a$)

where $\underline{\text{expression}}_a$ is the expression deriving from the further spelling out of THM, and place ($\underline{\text{expression}}_a$) in

(i) The First Argument position (3 in (3.1)) if and only if position 1 is filled by rule (3.11),

(ii) the Anterior Phrase position (1 in (3.1)) otherwise.

b) If RHM= VB(Z) and

(i) Z = ADJP or CNP, encode

Z as *Agree*/THM_0/(expression$_b$)

where expression$_b$ is the expression deriving from the further spelling out of Z, *Agree*/THM_0/ is the morphological agreement operation with respect to THM_0 and THM_0 is the THM of the lowest CAT embedding RHM and containing a THM,

(ii) otherwise encode

Z as (expression$_b$)

where expression$_b$ is as in (i);
for both (i) and (ii), place the resulting expression in the Second Argument position (5 in (3.1)).

(Corollary to (3.13) b) (i): If Z = ADJP or CNP and ADJP = ADJ (...) or CNP = CN (...), respectively, then

Agree/THM_0/(ADJP or CNP) is carried out as
Agree/THM_0/(ADJ or CN).)

c) If CAT=(THM, RHM, M:b(W)), encode

M:b(W) as (expression$_c$) deriving from the further spelling out of W, and place the expression in the First Verb Phrase position (2 in (3.1)).

d) If CAT= (THM,RHM, M:l(W)), encode

M:l(W) as (expression$_d$), deriving from the further spelling out of W, and place the expression in the Adverbial position (9 in (3.1)).

e) If CAT = (THM, RHM) and RHM = VB(Z, M:b(W)), encode

M:b(W) as (expression$_e$), deriving from the further spelling out of W, and place the expression in the Adverb position (7 in (3.1)).

Rule (3.13) calls for some comments. Subrule a) produces (for categorical predications) the characteristic verb-second surface order of Swedish. A corresponding subrule is formulated in the encoding rule for thetic predications. It is seen that the subrule is dependent upon the rule for encoding ANT/X/. The combined effects of (3.11) and (3.13)a) might be paraphrased as follows: first see if there is anything that must be placed in the Anterior position; if not, place the subject there.

It may well happen that there is no THM in the CAT which is about to be encoded. If so, subrule a) will simply fail to apply. This has consequences, however, for the Z of that CAT, necessitating the somewhat complicated formulation of subrule b). The problem is that Z must agree with something and if there is no THM present in the CAT, what then? The formulation chosen here means that the list structure must be scanned for the next highest full categorical predication. The THM of this higher CAT is then 'borrowed' by the agreement operation on the Z of the lower CAT. This device is rather similar to that used by Dahl in Dahl-Järborg 1975 13).

The conditions on the subrules c), d), e) are written in a simplified form, for convenience. The conditions are not supposed to be mutually exclusive. For example, if CAT=(THM, RHM, M:b(W1), M:b(W2), M:l(W3)), all the 'M':s are spelled out by c) and d). In a certain sense, then, the conditions could be said to apply recursively.

The final point concerns the verb, which is left out of rule (3.13). This is partly because the encoding rule for the verbs is common to both CAT and THS. Since the rule will apply rather to the syntactic specification level of (2.15), it also is perhaps of lower rank than (3.13) and (3.14).

(3.14) The encoding of THS

a) If THS is not SB or DO of another THS, encode the SB as ($\underline{\text{expression}}_a$), deriving from the further spelling out of SB, and place (expression$_a$) in

(i) the First Argument position (3 in (3.1)) if and only if position 1 is being filled by rule (3.11),

(ii) The Anterior Phrase position (1 in (3.1) otherwise.

b) encode

IO(A) as *Oblique*(expression$_b$)

where expression$_b$ derives from the further spelling out of A and *Oblique* is the morphological operation producing the oblique case (only of interest for some pronouns). Place *Oblique*(expression$_b$) in the Second Argument position (5 in (3.1)).

c) (i) If A=NOM(S) or NOM(PRED), encode

DO(A) as (expression$_c$), deriving from the further spelling out of A and place the expression in the Final Argument position (9 in (3.1)).

Optionally (?), place as in (ii).

(ii) otherwise, encode

DO(A) as *Oblique*(expression$_c$)

where expression$_c$ derives from the further spelling out of A and *Oblique* is as in b). Place *Oblique*(expression$_c$) in the Third Argument position (6 in (3.1)).

d) encode

PS(A) as (expression$_d$), deriving from the further spelling out of A, and place the expression in the Third Argument position (6 in (3.1)).

e) (i) If A = NOM(S) or NOM(PRED), encode

PREP$_x$(A) as (expression$_x$) and (expression$_e$)

where expression$_x$ and expression$_e$ derive from the further spelling out of PREP$_x$ and A, respectively, and place (expression$_x$) and (expression$_e$) in the Prepositional Argument position (8 in (3.1)).

(ii) otherwise, encode

PREP$_x$(A) as (expression$_x$) and *Oblique*(expression$_e$) where the expressions are as above and *Oblique* is as in b), place (expression$_x$) and *Oblique*(expression$_e$) in the Prepositional Argument position (8 in (3.1)).

f) If THS=VB(SB, CP, M:b(W)), encode

M:b(W) as (expression$_f$), deriving from the further spelling out of W, and place the expression in the First Verb Phrase position (2 in (3.1))

g) If THS= VB(SB, CP, M:l(W)), encode

M:l(W) as (expression$_g$), deriving from the further spelling out of W, and place the expression in the Adverbial position (9 in (3.1)).

h) If THS = VB(SB, CP) and CP=(. . . M:b(W)), encode

M:b(W) as (expression$_h$), deriving from the further spelling out of W, and place the expression in the Adverb position (7 in (3.1)).

Rule (3.14) is perhaps the most important and certainly the most complicated of the encoding rules. Nevertheless, it still does not cover all possibilities, as seen from the conditions on subrule a). To cover nominatives/accusatives with infinitives, some further rules are needed and will be given presently. (See in this connexion the treatment in Järborg 1975).

In subrule c), special provision is made for object clauses and object infinitive constructions, which are placed in the last position of (3.1). Thus, the Final Argument position of that rule is seen to be well-motivated. However, at most two of the post-verbal argument places can be filled at one time: the second and the third or the second and the fourth. In subrule e) it should be noted that the argument is encoded as two separate expressions, both of which normally are placed in the same position. The exception will be when rule (3.11) has applied. If we compare the subrules e) and g) we can see that the adverbials are encoded as single expressions at this stage. The syntax is thus able to predict that a prepositional argument may be fronted in two ways: with or without the preposition, while a prepositional phrase used as an adverbial can only be fronted as a whole. The surface word order within the Preposition argument position will be handled by a lower-level canonical form not yet developed; probably the same will serve for all prepositional phrases.

The necessary complements to rules (3.13) and (3.14) are the following:

(3.15) $\underline{\text{The encoding of THS}_i\text{ if the SB= A and A= PRED}_j}$

a) If K is the THM or SB of PRED$_j$, encode K as ($\underline{\text{expression}}_a$), deriving from the further spelling out of K, and place this expression according to (3.14)a) in the spelling out of THS$_i$.

b) Let ($\underline{\text{expression}}_b$) be the result of the further spelling out of PRED$_j$ apart from K. Place ($\underline{\text{expression}}_b$) according to (3.14)c) (ii) in the spelling out of THS$_i$.

(3.16) $\underline{\text{The encoding of THS}_i\text{ if the DO is A and A=PRED}_j}$

a) If K is the THM or SB of PRED$_j$, encode K according to (3.14)c) (ii) and place the resulting expression according to the last-named rule in the spelling out of THS$_i$ and according to (3.13) or (3.14)a)(ii) in the spelling out of PRED$_j$.

b) Let ($\underline{\text{expression}}_b$) be the result of the further spelling out of PRED$_j$ apart from K. Place ($\underline{\text{expression}}_b$) according to (3.14)c)(ii) in the spelling out of THS$_i$.

By means of rules (3.15) and (3.16) the chief peculiarity of nominative/accusative-with-infinitive construction is accounted for: i.e. the property that their subjects (in the traditional sense) are surface constituents of both the higher and the lower predication. The rules are written as complements to the main spelling-out rules, more in the interest of saving space than for expressing any generalizations.

To complete the survey of the main spelling-out rules, we will now consider the verb, bearing in mind that rule (3.10) is also relevant for this category.

(3i17) The encoding of VBa, where VBa is the total verb of a PRED

a) If VBa=VBx, where VBx is the main verb, encode

VBa as *Oper*($\underline{\text{expression}}_x$)

where $\underline{\text{expression}}_x$ derives from the further spelling out of VBx and *Oper* is some morphological operation. Place the resulting expression in the First Verb Phrase position (2 in (3.1)).

N.B. If NO morphological operation applies to a verb, it will be expressed in the surface by the INFINITIVE.

b) If VBa=PAST(VBx), where VBx is as above, encode

VBa as *Past*(*Oper*(expression_x))

where *Past* is the morphological operation producing the preterite form and the rest is as above. Place the resulting expression in the First Verb Phrase position (2 in (3.1)).

c) If VBa= VBb(SUP(VBx)), where VBx is as above, encode

VBa as *Oper*($\underline{\text{expression}}_b$) and *Supine*($\underline{\text{expression}}_x$)

where $\underline{\text{expression}}_b$ derives from the further spelling out of VBb, *Supine* is the morphological operation producing the supine form and the rest is as above. Place *Oper*($\underline{\text{expression}}_b$) in the First Verb Phrase position (2 in (3.1)) and *Supine*($\underline{\text{expression}}_x$) in the Main Verb Phrase position (4 in (3.1)).

d) If VBa=VBb(SUP(VBx)) and VBb=PAST(VBc), where VBx is as above, encode

VBa as *Past*(*Oper*($\underline{\text{expression}}_c$)) and *Supine*($\text{expression}_x$)

where $\underline{\text{expression}}_c$ derives from the further spelling out of VBc and the rest is as above. Place *Past*(*Oper*($\underline{\text{expression}}_c$)) in the First Verb Phrase position (2 in (3.1)) and *Supine*($\underline{\text{expression}}_x$)

in the Main Verb Phrase position (4 in (3.1)).

(3.18) The encoding of PASS
If VBx is the main verb and VBx= PASS(VBy) encode

VBx as *Pass* ($\underline{\text{expression}}_y$)

where $\underline{\text{expression}}_y$ derives from the further spelling out of VBy and *Pass* is the morphological operation producing the passive form.

In order to be able to spell out the categories PRED and S in embedded categorial contexts, we must have access to the following rule:

(3.19) The encoding of NOM

a) If A= NOM(S_i) and S_i= FIN(PRED), or S_i= ANT/X/(S_j) and S_j = FIN(PRED), encode NOM(S_i) by placing the expression (Att) in the Complementizer position (0 in (3.1)) in the spelling out of PRED.

b) encode

NOM(PRED) by placing the expression (Att) in the Complementizer position (0 in (3.1)[14].

The rules given for spelling out of PRED must be adjusted in some respects if any argument proper or any modifying argument is the operand of the operator m (minor). These adjustments will, unfortunately, complicate the hitherto rather neat encoding system, but such are the linguistic facts of Swedish.

(3.20) The encoding of mTHM and mSB
If m/THM/mSB belong to PRED and if some rule is filling the Anterior position (1 in (3.1)) in the spelling out of PRED, encode

mTHM/MSB as in (3.13), (3.14) but place the expressions in the First Verb Phrase position (2 in (3.1)).

(3.21) The encoding of mIO(A) and mDO(A)

If mIO, mDO belong to PRED and S=FIN(PRED) and S is not embedded and the First Argument and Main Verb Phrase position (3 and 4 in (3.1)) are not being filled by any rule, encode

a) mIO(A) as in (3.14) but place the expression in the First Verb Phrase position (2 in (3.1)).

b) If, furthermore, the Second Argument place (5 in (3.1) is not being filled by any rule, encode

mDO(A) as in (3.14) but place the expression in the First Verb Phrase position (2 in (3.1)).

(3.22) The encoding of $mPREP_x$ (A), mM:b(W) and mM:l(W)

Call all these categories mΩ, for the purposes of this rule. If mQ belongs to PRED, encode mQ as in (3.13), (3.14) but place the expression:

a) if the First Argument and the Main Verb Phrase positions (3 and 4 in (3.1)) are being filled by spelling out rules, in the Main Verb Phrase position (4 in (3.1)).

b) otherwise, in the First Verb Phrase position (2 in (3.1)).

Although these rules are formulated as clearly as possible, a short survey of the possible positions for modifiers seem to be necessary. First of all, a modifier may appear in the First Verb phrase. This is the only position for so-called sentence adverbs, like negation. The modifiers in question are of the type M:b and are introduced at the PRED level, as in (2.6) and (2.10). The same position is used for ALL minor modifiers when no main verb is present.

Secondly, only minor modifiers may occur in the Main Verb phrase, if there is a Main Verb and a First Argument.

Thirdly, there is the Adverb position (7 in (3.1). This is the position for all non-minor modifiers of type M:b originating at the RHM or CP level, as in (2.8) and (2.12); the typical case is ordinary adverbs of manner.

Fourthly, there is the Adverbial position (9 in (3.1)). This is the position for all non-minor modifiers of type M:1 originating at the PRED level, as in (2.6) and (2.10). Normal representatives of this class are adverbials of time and place.

Finally, and overriding all normal spelling out, there is the Anterior phrase position which may be filled, among other things, with any single non-minor modifier.

We will end this section by giving a rule for the spelling out of ADJP, which can also be taken as a model for the corresponding (partial) spelling out of noun phrases.

(3.23) The encoding of ADJP

(mainly for ADJP as Z but possibly also for ADJP as modifiers in CNP).

a) encode ADJ as *Oper*($\underline{\text{expression}}_a$)
where $\underline{\text{expression}}_a$ derives from the further spelling out of ADJ and *Oper* is some morphological operation. Place the resulting expression in the Adjective Phrase Proper position (2 in (3.2)).

b) encode IO(A) as *Oblique*($\underline{\text{expression}}_b$)
where $\underline{\text{expression}}_b$ derives from the further spelling out of A and *Oblique* is the same as in (3.14). Place the resulting expression in the First Argument position (1 in (3.2)).

c) encode DO(NOM(PRED)) as ($\underline{\text{expression}}_c$), deriving from the further spelling out of NOM(PRED) and place the resulting expression in the Final Argument position (3 in (3.2)).

d) encode PREP_x(A) as in (3.14)e) and place the resulting expressions in the Final Argument position (3 in (3.2)).

e) encode M:1(W) as ($\underline{\text{expression}}_e$), deriving from the further spelling out of W, and place the resulting expression in the Final Argument position (3 in (3.2)).

N.B: Any minor argument or modifier (not applicable on DO) is placed in the Front Argument position (1 in (3.2)).

4 EXAMPLES OF DERIVATIONS

In this section, a number of strategically chosen examples of syntactic derivations will be given. Taken together, these examples should illustrate most of the rules of the previous section. The derivations will be treated in some detail, in order to show that the syntactic system is capable of handling the details without fuzziness. Of course, some matters will be touched upon that have not been completely worked out; in such cases this will be clearly stated in the comments. This is true particularly of the treatment of the inner structure of noun phrases and of pronouns.

We will start by considering some very simple examples of the two main types of sentences.

(4.1) Pelle är nykter nu.
'P. is sober now'

List structure:

S1=FIN(CAT2)
CAT2=(THM3, RHM4, M:1(ADV5))
THM3=NP6
RHM4=VB7(ADJP8)
ADV5=Nu
NP6=Pelle
VB7=Vara
ADJP8=ADJ9
ADJ9=Nykter

Syntactic spelling out:

1) Line 1 (and lines 4, 7): When spelling out at a lower level, the expression *Fin*('VB7') is to be used, according to (3.10)[15].

2) Lines 2, 3, 4:

a) (Pelle) in position 1, according to (3.13)a)(ii)

b) *Agree*/THM3/(Nykter) in position 5, according to (3.13)b)(i)

c) (Nu) in position 9, according to (3.13)d).

3) Line 7:

Fin(Vara) in position 2, according to (3.17)a).

Result of syntactic spelling out:

(Pelle)⁀*Fin*(Vara)⁀*Agree*/THM3/(Nykter)⁀(Nu)

Result of morphological spelling out:

Pelle⁀är⁀nykter+0⁀nu

The spelling out is fairly straightforward. The notable points seem to be step 1), where the instruction to perform an extra morphological operation later on is given, and step 2)b) where the correct parameter for the *Agree* operation must be found (which is very simple in this case). The result of the syntactic spelling out is given in a form which neglects the empty positions of the surface canonical form (3.1). Sooner or later the empty positions must be eliminated anyway; doing it here saves some space. The morphological spelling out should be considered only an educated guess; for a more complete account of the type of morphology contemplated for operational grammar see Källström 1977. It is clear that the morphological spelling-out rules must have access to the list structure, in order to extract the relevant morphological features of THM3.

(4.2) Pelle har inte slagit Kalle.
'P. has not hit K.'

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5, M:b(ADV6))
VB3=VB7(SUP(VB8))
SB4=NP9
CP5=(DO(NP10))
ADV6=Inte
VB7=Hava
VB8=Slå
NP9=Pelle
NP10=Kalle

Syntactic spelling out:

1) Line 1 (and lines 3, 7): When spelling out at a lower level, the expression *Fin*('VB7') is to be used, according to (3.10).

2) Lines 2, 4, 5 (and lines 6, 9, 10):

a) (Pelle) in position 1, according to (3.14)a)(ii)

b) *Oblique*(Kalle) in position 6, according to (3.14)c)(ii)

c) (Inte) in position 2, according to (3.14)f).

3) Line 3 (and lines 7, 8):

a) *Fin*(Hava) in position 2, according to (3.17)c)

b) *Supine*(Slå) in position 4, according to (3.17)c).

Result of syntactic spelling out:

(Pelle)⁀*Fin*(Hava)⁀(Inte)⁀*Supine*(Slå)⁀*Oblique*(Kalle), acc. to (3.7)

Result of morphological spelling out:

Pelle⁀ha+r⁀inte⁀slag+it⁀Kalle+Ø

The spelling out does not offer any difficulties; indeed, to spell out by means of (3.14) is basically simpler than by (3.13), since there are no *Agree* operations to complicate the matter. The only point worthy of special attention is the result of the syntactic spelling out, where the expressions *Fin*(Hava) and (Inte) are placed in the same surface position of (3.1). Here, we must appeal to the lower-level surface form (3.7) to obtain the correct order. There are no difficulties in principle about the morphological spelling out.

(4.3) Dittills hade aldrig Pelle varit nykter.
'Until then, P. had never been sober'

List structure:

S1=ANT/M:1(ADV2)/(S3)
ADV2=Dittills
S3=FIN(CAT4)
CAT4=(THM5, RHM6, M:b(ADV7), M:1(ADV2))
THM5=NP8
RHM6=VB9(ADJP10)

ADV7=Aldrig
NP8=Pelle
VB9=VB11(SUP(VB12))
ADJP10=ADJ13
VB11=PAST(VB14)
VB12=Vara
ADJ13=Nykter
VB14=Hava

Syntactic spelling out:

1) Line 1: The expression ('M:1(ADV2)') is to be placed in position 1 in the spelling out of CAT4, according to (3.11).

2) Line 3 (and lines 9, 11, 12): When spelling out a lower level, the expression *Fin*('VB14') is to be used, according to (3.10).

3) Lines 4, 5, 6 (and lines 2, 7, 8, 10, 13):

a) (Pelle) in position 3, according to (3.13)a) (i)

b) *Agree*/THM5/(Nykter) in position 5, according to (3.13)b)(i)

c) (Aldrig) in position 2, according to (3.13)c)

d) (Dittills) in position 1, according to (3.13)d) and (3.12).

4) Line 9 (and lines 11, 12, 14):

a) *Past*(*Fin*(Hava)) in position 2, according to (3.17)d)

b) *Supine*(Vara) in position 4, according to (3.17)d).

Result of syntactic spelling out:

(Dittills)⁀*Past*(*Fin*(Hava))⁀(Aldrig)⁀(Pelle)⁀*Supine*(Vara)⁀
⁀*Agree*/THM5/(Nykter) , acc. to (3.7)

Result of morphological spelling out:

Dittills⁀ha+de⁀aldrig⁀Pelle⁀var+it⁀nykter+Ø

In this example, step 1) should be noted, as it contains an instruction overriding the normal placement rules. This instruction must be given in the abstract notation ('M:1(ADV2)'), since the expression-to-be is spelled out at a later stage, in step 3)d). Note that the auxiliary verb is encoded by means of two morphological operations, *Past* as well as *Fin*. This outcome is due to the treatment of finitization in this version, but it is a slight complication for the morphological spelling out. Here, it is assumed that *Past*(*Fin*(VB)) = *Past*(VB); i.e. that *Fin* applies vacuously when another operation applies.

(4.4) Lisa har sett tydligt att Pelle inte slog Kalle.
'L. has seen clearly that P. not hit K.' (i.e. 'did not hit')

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=VB6(SUP(VB7))
SB4=NP8
CP5=(DO(NOM(S9)), M:b(ADV10))
VB6=Hava
VB7=Se
NP8=Lisa
S9=FIN(THS11)
ADV10=Tydligt
THS11=VB12(SB13, CP14, M:b(ADV15))
VB12=PAST(VB16)
SB13=NP17
CP14=(DO(NP18))
ADV15=Inte
VB16=Slå
NP17=Pelle
NP18=Kalle

Syntactic spelling out:

1) Line 1 (and lines 3, 6): When spelling out at a lower level, the expression *Fin*('VB6') is to be used, according to (3.10).

2) Line 2 (and lines 4, 5):
a) (Lisa) in position 1, according to (3.14)a)(ii)
b) ('NOM(S9)') in position 9, according to (3.14)c)(i)
c) (Tydligt) in position 7, according to (3.14)h).

3) Line 3 (and lines 6, 7):
a) *Fin*(Hava) in position 2, according to (3.17)c)
b) *Supine*(Se) in position 4, according to (3.17)c).

4) Line 9 (and line 12): When spelling out at a lower level, the expression *Fin*('VB16') is to be used, according to (3.10).

5) Line 11 (and lines 13, 14, 15); within the position of('NOM(S9)'):

a) (Att) in position 0, according to (3.19)a)

b) (Pelle) in position 1, according to (3.14)a)(ii)

c) *Oblique*(Kalle) in position 6, according to (3.14)c)(ii)

d) (Inte) in position 2, according to (3.14)f).

6) Line 12; within the position of ('NOM(S9)'):
Past(*Fin*(Slå)) in position 2, according to (3.17)b).

Result of syntactic spelling out:

(Lisa)⌒*Fin*(Hava)⌒*Supine*(Se)⌒(Tydligt)⌒(Att)⌒(Pelle)⌒(Inte)⌒
Past(*Fin*(Slå))⌒*Oblique*(Kalle) , acc. to (3.8)

Result of morphological spelling out:

Lisa⌒ha+r⌒se+tt⌒tydligt⌒att⌒Pelle⌒inte⌒slog⌒Kalle+Ø

In this example, there is an embedded sentence present. This means that there must be two principal steps in the spelling out: step 2) for the higher and step 5) for the lower sentence (i.e. predication). The placement of the surface constituents of the lower sentence is limited to the slot alloted for the lower sentence in its role as a surface constituent in the higher sentence. The complementizer att, arising from the spelling out of the lower sentence and the word order within the First Verb Phrase of that sentence should be noted. Incidentally, sentence (4.4) is not very good Swedish: normally (at least in the written language) one would express approximately the same meaning by

(4.4') Lisa har tydligt sett att Pelle inte slog Kalle.

The sentence would differ from (4.4) by line 5 in the list structure, which would have mM:b (ADV10) instead of M:b(ADV10). In the spelling out, rule (3.22) would apply, producing the surface form of (4.4'). Cf. the next example.

(4.5) Lisa har tydligt sett Pelle slå Kalle.
'L. has clearly seen P. hit K.'

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=VB6(SUP(VB7))
SB4=NP8
CP5=(DO(THS9), mM:b(ADV10)
VB6=Hava
VB7=Se
NP8=Lisa
THS9=VB11(SB12, CP13)
ADV10=Tydligt
VB11=Slå
SB12=NP14
CP13=(DO(NP15))
NP14=Pelle
NP15=Kalle

Syntactic spelling out:

1) Line 1 (and lines 3, 6): When spelling out at a lower level, the expression *Fin*('VB6') is to be used, according to (3.17)c).
2) Line 2 (and lines 4, 5, 9):
a) (Lisa) in position 1, according to (3.14)a)(ii)
b) *Oblique*(Pelle) in position 6, according to (3.16)a) and (3.14)c)(ii
c) The expression ('THS9'), apart from ('SB12'), in position 6, according to (3.16)b) and (3.14)c)(ii)
d) (Tydligt) in position 2, according to (3.22)b) and (3.14)h).
3) Line 3 (and lines 6, 7):
a) *Fin*(Hava) in position 2, according to (3.17)c)
b) *Supine*(Se) in position 4, according to (3.17)c).
4) Line 9 (and line 13); within the position of ('THS9'):
Oblique(Kalle) in position 6, according to (3.14)c)(ii).
5) Line 11; within the position of ('THS9'):
(Slå) in position 2, according to (3.17)a).

Result of syntactic spelling out:

(Lisa)⁀*Fin*(Hava)⁀(Tydligt)⁀*Supine*(Se)⁀*Oblique*(Pelle)⁀(Slå)
⁀*Oblique*(Kalle)

Result of morphological spelling out:

Lisa⁀ha+r⁀tydligt⁀se+tt⁀Pelle+0⁀slå⁀Kalle+0

In the crucial steps 2)b) and c), the spelling out of the lower THS9 is split into two, following the rule (3.16). The ordering of the surface constituents within position 6 of the upper THS2 is handled by the stipulation in rule (3.16)a), together with a lower-level reapplication of (3.1).

For sentences of the type (4.5), a negation in the infinitive construction does not make an entirely natural impression. However, if the negation were introduced, in order to make (4.4) and (4.5) even more comparable, it would appear in the list structure in line 9, as a M:b. According to (3.14)f) and (3.8), it would be placed first in the lower First Verb Phrase, producing

(4.5') Lisa har tydligt sett Pelle inte slå Kalle.

(4.6) Pelle sågs slå Kalle.
'P. was seen hit K.' (i.e. 'hitting K.')

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=PAST(VB6)
SB4=THS7
CP5=0
VB6=PASS(VB8)
THS7=VB9(SB10, CP11)
VB8=Slå
VB9=Se

SB10=NP12
CP11=(DO(NP13))
NP12=Pelle
NP13=Kalle

Syntactic spelling out:

1) Line 1 (and line 3): When spelling out at a lower level, the expression *Fin*('VB6') is to be used, according to (3.10).

2) Line 2 (and lines 4, 7):

a) (Pelle) in position 1, according to (3.15)a) and (3.14)a)(ii)

b) The expression ('THS7'), apart from ('SB10'), in position 6, according to (3.15)b) and (3.14)c)(ii).

3) Line 3 (and lines 6, 8):
Past(*Fin*(*Pass*(Se)))in position 2, according to (3.18) and (3.17)b).

4) Line 7 (and lines 10, 11); within the position of ('THS7') apart from ('SB10'):
Oblique(Kalle) in position 6, according to (3.14)c)(ii).

5) Line 9; within the position of ('THS7') apart from ('SB10'):
(Slå) in position 2, according to (3.17)a).

Result of syntactic spelling out:

(Pelle)⁀*Past*(*Fin*(*Pass*(Se)))⁀(Slå)⁀*Oblique*(Kalle)

Result of morphological spelling out:

Pelle⁀såg+s⁀slå⁀Kalle+Ø

There is little new in this example compared with (4.5), except that the use of a passive construction produces the ponderous surface verb in the second position of the result of the syntactic spelling out. This seems unavoidable within the present framework; hopefully, it is possible to construct a morphological component capable of handling such verbs.

(4.7) Pelle gjorde Lisa glad.
'P. made L. happy'

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=PAST(VB6)
SB4=NP7
CP5=(DO(CAT8))
VB6=Göra
NP7=Pelle
CAT8=(THM9, RHM10)
THM9=NP11
RHM10=VB12(ADJP13)
NP11=Lisa
VB12=Ø
ADJP13=ADJ14
ADJ14=Glad

Syntactic spelling out:

1) Line 1 (and line 3): When spelling out at a lower level, the expression *Fin*('VB6') is to be used, according to (3.10).
2) Line 2 (and lines 4, 5, 8):
a) (Pelle) in position 1, according to (3.14)a)(ii)
b) *Oblique*(Lisa) in position 6, according to (3.16)a) and (3.14)c)(ii)
c) The expression ('CAT8'), apart from ('THM9'), in position 6, according to (3.16)b) and (3.14)c)(ii).
3) Line 3 (and line 6):
Past(*Fin*(Göra)) in position 2, according to (3.17)b).
4) Line 8 (and line 10); within the position of ('CAT8'):
Agree/THM9/(Glad) in position 5, according to (3.13)b)(i).

Result of syntactic spelling out:

(Pelle)⁀*Past*(*Fin*(Göra))⁀*Oblique*(Lisa)⁀*Agree*/THM9/(Glad)

Result of morphological spelling out:

Pelle⁀gjor+de⁀Lisa+Ø⁀glad+Ø

The full point of the examples (4.5) and (4.7) will appear if the second surface noun phrase is a personal pronoun and, for the latter case, if the THM is e.g. in the plural. If we restrict ourselves to written Swedish of a non-colloquial style, there is still a difference made between nominative de 'they' and oblique dem 'them'. If we modify (4.7) slightly, we get

(4.7') Pelle gjorde dem glada.
'P. made them happy'

which will be spelled out perfectly well by the same procedure, given that the eleventh line of the list structure reads NP11=De (and always supposing that the morphological component is up to the task).

(4.8) Pelle försökte att göra Lisa glad.
'P. tried to make L. happy'

List structure:

S1=FIN(THS2)
THS2=VB3(SB4, CP5)
VB3=PAST(VB6)
SB4=NP7
CP5=(DO(NOM(THS8)))
VB6=Försöka
NP7=Pelle
THS8=VB9(SB10, CP11)
VB9=Göra
SB10=Ø
CP11=(DO(CAT12))
CAT12=(THM13, RHM14)
THM13=NP15
RHM14=VB16(ADJP17)
NP15=Lisa
VB16=Ø
ADJP17=ADJ18
ADJ18=Glad

Syntactic spelling out:

1) Line 1 (and line 3): When spelling out at a lower level, the expression *Fin*('VB6') is to be used, according to (3.10).

2) Line 2 (and lines 4, 5):

a) (Pelle) in position 1, according to (3.14)a)(ii) .

b) ('NOM(THS8)') in position 9, according to (3.14)c)(i).

3) Line 3 (and line 6):
Past(*Fin*(Försöka)) in position 2, according to (3.17)b).

4) Line 8 (and lines 10, 11); within the position of ('NOM(THS8)'):

a) (Att) in position 0, according to (3.19)b)

b) *Oblique*(Lisa) in position 6, according to (3.16)a) and (3.14)c)(ii)

c) The expression ('CAT12') apart from ('THM13') in position 6, according to (3.16)b) and (3.14)c)(ii).

5) Line 9; within the position of ('NOM(THS8)'):
(Göra) in position 2, according to (3.17)a).

6) Line 12 (and line 14); within the position of ('CAT12'):
Agree/THM13/(Glad) in position 5, according to (3.13)b)(i).

Result of syntactic spelling out:

(Pelle)⁀*Past*(*Fin*(Försöka))⁀(Att)⁀(Göra)⁀*Oblique*(Lisa)⁀*Agree*/THM13/(Glad)
Result of morphological spelling out:
Pelle⁀försök+te⁀att⁀göra⁀Lisa+Ø⁀glad+Ø

In passing, it should be pointed out that the complementizer att is optional in sentences of type (4.8). With some other verbs, notably the modals, there must not be an att. Rule (3.19)b) is thus subject to lexically specified exceptions. If not att is present, very long sequences of surface verbs may appear, like skulle ha kunnat vilja göra 'should have been able to want to do'. In this version of operational syntax, such sequences are supposed to be representations of 'nested theses', where each new infinitive corresponds to a (lower) THS, in the same way as in (4.8).

(4.9) Lisa var honom fager att skåda.[16)]
'L. was for him fair to look at'

List structure:

S1=FIN(CAT2)
CAT2=(THM3, RHM4)
THM3=NP5
RHM4=VB6(ADJP7)
NP5=Lisa
VB6=PAST(VB8)
ADJP7=ADJ9(IO(NP10), DO(NOM(THS11)))
VB8=Vara
ADJ9=Fager
NP10=Han
THS11=VB12(SB13, CP14)
VB12=Skåda
SB13=∅
CP14=∅

Syntactic spelling out:

1) Line 1 (and lines 4, 6): When spelling out at a lower level, the expression *Fin*('VB8') is to be used, according to (3.10).

2) Lines 2, 3, 4:

a) (Lisa) in position 1, according to (3.13)a)(ii)

b) *Agree*/THM3/('ADJP7') in position 5, according to (3.13)b)(i).

3) Line 6 (and line 8):
Past(*Fin*(Vara)) in position 2, according to (3.17)b).

4) Line 7 (and lines 9, 10, 11); within the position of *Agree*/THM3/('ADJP7')

a) *Agree*/THM3/(Fager) in position 2, according to (3.13)b), corollary, and (3.23)a)

b) *Oblique*(Han) in position 1, according to (3.23)b).

c) The expression ('NOM(THS11)') in position 3, according to (3.23)c).

5) Line 11 (and lines 13, 14); within the position of ('NOM(THS11)'): (Att) in position 0, according to (3.19)b).

6) Line 12, within the position of ('NOM(THS11)'):
(Skåda) in position 2, according to (3.17)a):

Result of syntactic spelling out:

(Lisa)⁀*Past*(*Fin*(Vara))⁀*Oblique*(Han)⁀*Agree*/THM3/(Fager)⁀(Att)⁀(Skåda) acc. also to (3.2).

Result of morphological spelling out:

Lisa⁀var⁀honom⁀fager+Ø⁀att⁀skåda

There are no special difficulties with this sentence; it is inserted mainly to show the power of the syntax. It may be noted that (4.9), as well as (4.8), possesses two levels of embedded structures: in (4.8) the 'embedding order' goes THS - THS - CAT and in (4.9) it goes CAT - ADJP - THS.

(4.10) Då gav han henne dem inte.
'Then he gave her them not' (i.e. 'did not give them to her')

List structure:

S1=ANT/M:1(ADV2)/ (S3)
ADV2=Då
S3=FIN(THS4)
THS4=VB5(mSB6, CP7, M:b(ADV8), M:1(ADV2))
VB5=PAST(VB9)
mSB6=NP10
CP7=(mIO(NP11), mDO(NP12))
ADV8=Inte
VB9=Giva
NP10=Han
NP11=Hon
NP12=De

Syntactic spelling out:

1) Line 1: The expression ('M:1(ADV2)') is to be placed in position 1 in the spelling out of THS4, according to (3.11).
2) Line 3 (and line 5): When spelling out at a lower level, the expression *Fin*('VB9') is to be used, according to (3.10).
3) Line 4 (and lines 6, 7):
a) (Han) in position 2, according to (3.20) and (3.14)a)
b) *Oblique*(Hon) in position 2, according to (3.21)a) and (3.14)b)
c) *Oblique*(De) in position 2, according to (3.21)b) and (3.14)c)
d) (Inte) in position 2, according to (3.14)f)
e) (Då) in position 1, according to (3.14)g) and (3.12).
4) Line 5 (and line 9):
Past(*Fin*(Giva)) in position 2, according to (3.17)b).

Result of syntactic spelling out:

(Då)⁀*Past*(*Fin*(Giva))⁀(Han)⁀*Oblique*(Hon)⁀*Oblique*(De)⁀(Inte)

acc. to (3.7) and analogical application (vs. position 2) of (3.1)

Result of morphological spelling out:

Då⁀gav⁀han⁀henne⁀dem⁀inte

The difficulty of this rather special spelling out is the ordering between the enclitic arguments; as a group, they must precede the negation, as is clear from (3.7). I do not think I am stretching the notion of analogical application too far by letting rule (3.1) prescribe the order enclitic subject - enclitic indirect object - enclitic direct object within the First Verb Phrase position. Sentences of this type are rare enough; as soon as some factors are changed, the arguments will start returning to their normal positions.

5 CONCLUDING REMARKS

If the diligent reader has made it this far, he would probably like to know a) what it all is supposed to be good for, and b) whether the author really believes in his own system. I will try to satisfy the curiosity of my reader with some brief comments.

It may legitimately be asked what the present grammatical system will accomplish that is not already covered by the well-developed formalism of transformational grammar. One of the theoretical advantages of operational grammar is that the underlying syntactic representations ought to be more amenable to logical interpretation than the deep structures of transformational grammar. In practice, however, the main advantage of the list structures of operational grammar would seem to be the freedom from the over-rigid tree-structure format of transformational grammar, which is, after all, only an idealization of surface structure IC analysis. (It must be borne in mind that the rigid format of transformational grammar still is not sufficient to restrict it as much as Chomsky originally intended). In this paper, I have utilized this freedom by providing some subtly differing underlying structures for similar, nearly-synonymous sentences. This would be impossible in transformational grammar for methodological reasons as well: the somewhat simplistic view of so-called syntactic relationship would demand that one deep structure should be selected and the other structures should be transformationally derived. As syntactic relations probably are a subtle, multi-dimensional phenomenon, the methodological approach chosen here would seem superior.

A freedom from artificial restrictions on underlying structures (like obligatory ordering, tree-structure format, the syntactic relationship dogma) can, however, very easily be combined with a fairly stringent rule system for the generation of surface expressions. This is what I have set out to show, and I believe that in some respects I have accomplished it, at least for higher-level syntax. Of course, I do not claim that either the spelling-out rules or the surface canonical forms are perfect in their present state. I do claim, however, that my spelling-out system is basically simpler and more stringent than any grammar where words are being moved around the whole sentence by ill-defined transformations.

To sum up I hope I have presented the outlines of a syntactic formalism which may, when fully developed, be superior to transformational grammar. This may, in turn, be of value at least for casting light on complicated syntactic problems.

As for the second question: do I believe in my own system? I think the spelling-out rules and the canonical forms for surface strings, considered as parts of a production grammar, have some claim to psychological reality. At present I am, however, more inclined to believe in a system of rules of partial ordering as an alternative to placement rules and canonical forms. (This alternative was considered during the whole work and finally discareded mainly for practical reasons). The status of the list structures is, however, dubious. I think it will prove necessary to postulate some underlying syntactic representation, but there is no evidence that the list structures, with their logical heritage, are the proper way to proceed. The problem of deep syntax probably needs a completely fresh approach.

The work within the Research Project for Logical Grammar has thus, for my part, resulted in a syntactic model, the surface part of which I believe in, and the deep structure part of which I am prepared to discard. This slightly paradoxical position is, alas, nothing new in the field of theoretical linguistics.

FOOTNOTES

0 Jens Allwood, Östen Dahl and Roger Källström have read this paper in manuscript and have provided several valuable comments and suggestions, for which I thank them. They are, however, blameless for any remaining inadequacies.

1 There are two types of distinctions involved here. Firstly, there is the SEMANTIC distinction between absurd and contradictory/ paradoxical contents of sentences. Clearly, to speak of the furious sleeping of colourless green ideas is absurd and, in the ordinary way of things, nobody would do so. Slightly less extreme examples may of course be produced by some language users, notably by modernistic poets; but then they are often preoccupied with trying to express the inexpressible. Apart from such marginal phenomena, my claim is simply that there are certain possible contents of sentences which simply are POINTLESS. This is quite a different thing from the logical property of contradictoriness. It is not hard to construct examples where it makes perfectly good sense to use a contradictory sentence: one might describe the essential moving part of a Wankel engine as a 'round triangle' or one might describe a man as being 'good AND bad'. Although formally contradictory, such statements do not seem pointless. (Of course, most contradictions are certainly also pointless).

Secondly, there is the distinction between the SEMANTIC restrictions on contents (always gradual) and the SYNTACTIC restrictions on the details of linguistic structures (often absolute). This is basically Chomsky's distinction (Chomsky 1965) between selectional restriction and strict subcategorization, although Chomsky, for some reason best known to himself, regarded both types of restrictions as syntactic. My proposed 'lexically dependent rules' are meant to handle the subcategorization only.

2 The age-old observation on the relation between word-order and morphological marking is perhaps best expressed in the following way, within the present framework. On one hand, there is a two-dimensional space (say), generated by the prosodic dimension and the dimension of linear order. On the other hand, there is a (probably multi-dimensional) space of morphological marking features. The trading relation will now hold between these two main spaces.

3 The slash notation, /X/, is used for parameters governing the exact form of syntactic matrices or morphological operations. It is most conveniently read as 'relative to X'. In the present example, we would thus get e.g. 'apply morphological operation Oper_2, relative to (case index) X, on the lexeme $\underline{\text{Lexeme}}_3$. For an example involving matrices, see (2.2).

4 Jens Allwood and Östen Dahl, personal communication.

5 As will be clear from the further rules of this section, the fragment of Swedish describable by this grammar does not include coordinated constructions. This means that I need not, at present, try to accomodate the operational-grammar equivalent of Ross' Coordinate Structure Constraint within the restrictions of rule (2.2) (cf. Ross 1967). When extending the grammar, the relevant

FOOTNOTES (cont.)

restriction could be stated either at this place or in the rule forming coordinated arguments.

6 Of course, Swedish possesses several syntactic devices for bringing out essentially the same semantic distinction as Japanese achieves with the well-known -wa and -ga morphemes (topic and subject marking, respectively). One such device seems to be unstressed Left Dislocation, to use the transformational term, as in

(i) Pelle, han skriver på sin avhandling.
'(lit.) P., he writes on his dissertation'.

The point is simply that a clear topic marking in Swedish requires additional devices beyond the basic and straightforward syntactic rules, in contrast to Japanese where the presence or absence of topic-marking is central to the system.

7 Rule (2.8) is somewhat too generous as written, since it seems that only Bliva, Varda and, marginally, Förbliva, can take M:b(W) arguments. This fact is interesting, as it would give these verbs a syntactic position between the 'pure' categorical verb Vara and the thetic verbs; something which makes good sense from a semantic point of view.

8 The notion of semantic load is NOT to be confused with any of the so-called functional speech categories, like 'new information' and so on. In terms of such categories it may indeed happen that the predicative, say, is the 'new' information conveyed by a sentence, while the theme, the other member of the pair, is old and well-known. I doubt whether 'new' and 'old' information should be reckoned semantic categories at all; rather it seems that they might be the pragmatic counterparts of the semantic categories of prominence and background. What is at issue here is a logically prior notion: namely the existence of any information, be it old or new.

9 Archaically and in dialects also Vara, although this auxiliary demands the past participle rather than the supine. It is a moot point whether this construction should instead be regarded as a categorial predication, with the participle as a kind of ADJP.

10 For some reason this sentence is marginal in Swedish.

11 The term 'enclitic' is perhaps misleading; a better term would probably be 'light' or 'weak' argument(s).

12 Verbal particles have been neglected in the present fragment. However, it seems that they could easily be handled by always

FOOTNOTES (cont.)

being placed in the main verb phrase. This solution would necessitate that (3.9) be extended with a Position 3: Verbal particle.

13 It may occasionally happen that there is no CAT embedding the RHM. In this case, the agreement operation will have to make do with the 'lowest' SB as a parameter. Rule (3.13)b)(i) is thus slightly deficient as it stands.

14 This is too categorical, since (3.19)b) has a number of lexically dependent exceptions. Cf. the comment to example (4.8).

15 The notation is introduced in the discussion leading up to example (3.4').

16 This sentence is distinctly archaic. As it is hard to find a really adequate English translation, the word-for-word translation has been left as it is.

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AGREEMENT RULES FOR SWEDISH NOUN PHRASES

ROGER KÄLLSTRÖM

1 AGREEMENT IN SWEDISH NOUN PHRASES

In this section, I will state some of the facts of nominal inflection in Swedish. I will concentrate on the agreement of articles, adjectives, demonstrative pronouns, numerals and nouns. My main source of information is Beckman 1964.

It is traditionally said that the following three categories are involved in Swedish noun phrase agreement: (a) *number* (singular/plural), (b) *gender* (utrum[1]/neuter), (c) *definiteness* (indefinite/definite). The traditional view is that the head noun of an NP carries number, gender and definiteness (signalled normally by suffixes). The various inflectable modifiers then agree with the head noun in one or more of the three categories. Below, I will discuss the inflection of the five word-classes mentioned above.

Nouns.

Nouns are inflected for number, gender, definiteness, and case. There are two cases in Swedish (for nouns, that is; some pronouns have an object case): the *base form* and the *genitive*. Case is irrelevant for agreement in Swedish. Diagram (1) shows the suffixes that nouns take when inflected for number, gender or definiteness.

Diagram 1

		Singular	Plural
Indefinite	Utrum	0	{-or, -ar, -er, -r, 0}
	Neuter	0	{-or, -er, -n, 0}
Definite	Utrum	-en, -n	{-or, -ar, -er, -r, 0} + -na
	Neuter	-et, -t	{-or, -er} + -na -n + -a 0 + -en

The definite form of a noun is always marked by a suffix. The definite suffix is always preceded by the plural suffix, if there is one. The declension the noun belongs to determines the choice of plural suffix. Gender is signalled by the definite ending in the singular.

As can be seen from diagram (2), gender is also relevant for the choice of plural ending. Only utral nouns take -ar and -r, and only neutral ones take -n. In fact, the correlation between gender and plural suffix is even stronger, since the neutra with plural in -or are very few and all end in -a in the singular. Derivatives in -are are the only utra with no plural suffix. Minor types and exceptions apart, diagrams (2) and (3) illustrate Swedish noun inflection.

Diagram 2

Gender: Utrum

	Singular		Plural
Indefinite	flicka	'girl'	flick+or
	häst	'horse'	häst+ar
	gäst	'guest'	gäst+er
	fot	'foot'	fött+er
	ko	'cow'	ko+r
	lärare	'teacher'	lärare
Definite	flicka+n		flick+or+na
	häst+en		häst+ar+na
	gäst+en		gäst+er+na
	fot+en		fött+er+na
	ko+n		ko+r+na
	lärare+n		lärar+na

Diagram 3

Gender: Neuter

	Singular		Plural
Indefinite	prisma	'prism'	prism+or
	parti	'party'	parti+er
	bi	'bee'	bi+n
	hus	'house'	hus
Definite	prisma+t		prism+or+na
	parti+(e)t		parti+er+na
	bi+(e)t		bi+n+a
	hus+et		hus+en

Adjectives.

Adjectives agree in number, gender and definiteness with their head nouns. The endings they take are shown in diagram (4).

Diagram 4

		Singular	Plural
Indefinite	Utrum Neuter	0 -t	-a -a
Definite	Utrum Neuter	-a -a	-a -a

As can be seen, the gender distinction is overt only in the indefinite singular. -a signals definite and / or plural.
In many dialects, singular, masculine, and definite adjectives have final -e instead of -a. It should be stressed again (cf. fn.(1)) that I will treat only dialects with the distribution of suffixes shown in diagram (4).
Some examples of adjective inflection are given below:

(1)	(en) brun häst	'(a) brown horse'
(2)	(ett) brunt hus	'(a) brown house'
(3)	den brun+a hästen	'the brown horse'
(4)	brun+a hus	'brown houses'

The definite article.

In (3) above, we have an example of the *preposed definite article.* This article has a peculiar distribution which can be stated as follows: it is obligatorily present if an adjectival attribute (adjective, numeral, etc.) is present in a definite NP.
If there is no adjectival attribute, it is absent. In such cases the definite ending of the noun (the *suffixed definite article*) alone signals definiteness. Thus we have (3) below with preposed article but (5) without. (6) is marginally possible as a proper name, (7) is, with normal intonation, impossible.

(3)	den bruna hästen	'the brown horse'
(5)	hästen	'the horse'
(6)	*bruna hästen	
(7)	*den hästen	

The preposed definite article is inflected for number and gender as in diagram (5).

Diagram 5

	Singular	Plural
Utrum	den	de
Neuter	det	

Demonstrative Pronouns.

Demonstrative pronouns are inflected for number and gender. The inflectional paradigms for three such pronouns are given below:

Diagram 6

denna - 'this'

	Singular	Plural
Utrum	denna	dessa
Neuter	detta	

Diagram 7

den här - 'this'

	Singular	Plural
Utrum	den här	de här
Neuter	det här	

Diagram 8

den där - 'that'

	Singular	Plural
Utrum	den där	de där
Neuter	det där	

These pronouns function differently with respect to agreement. Den här and den där are like the preposed definite article, in that after them, both adjectives and nouns get the definite form. But after denna, only the adjective gets the definite form; the noun has its indefinite form.[2] Cf. (8) and (9) below.

(8) den här brun+a häst+en 'this brown (def) horse (def)'

(9) denna brun+a häst 'this brown (def) horse (indef)'

Numerals.

Numerals are not inflected, except the word for 'one', 'a', which agrees in gender with its head noun: utrum en, neuter ett. En/ett is also the *indefinite article* in Swedish.

Here, and in Dahl, Järborg and Källström 1974, the numerals are included in the class of *quantifiers*, which also comprises some so-called *indefinite pronouns*. Some of the latter are inflected for number and gender, but in this paper, I will use numerals only as examples of the operational category of quantifiers.

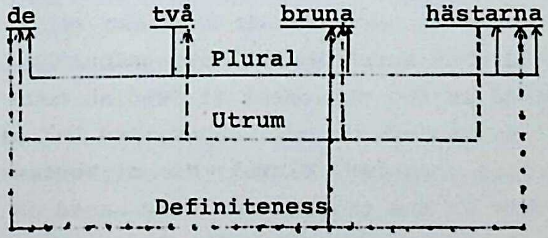
2 ASSIGNMENT OF MORPHOLOGICAL PROPERTIES TO NOUN PHRASES

Now let us consider the problem of agreement within the NP from a somewhat different angle than the largely traditional one adopted in the preceding section. Let us think of words which agree with each other as picking up one property here, another there, maybe even contributing a property of their own. The properties I am speaking about are of course morphological properties like plural, neuter, etc. Let us look at a Swedish noun phrase and see where the different morphological properties might come from.

(10) de två bruna hästarna 'the two brown horses'

In (10), the adjective and the noun are both in the definite form. Let us say that they have picked up their definiteness from the definite article. De, bruna and hästarna are all plural. We can say that they have picked up their number from the numeral två. Gender does not play any role in the agreement of the definite article and the adjective in this case, though in other cases (singular), it does. The only way gender shows up in this example, is in the plural ending of the noun: As we have said before p.268, all nouns that take -ar in the plural are utral. The obvious place to pick up gender is from the noun. If we accept the view proposed here, we can draw the following diagram for (10).

Diagram 9



Since plural, utrum, and definite are the morphological properties that the component words of (10) have, it seems natural to say that (10) is a plural, utral, and definite NP.
In the same way, we may refer to the morphological properties of an NP if we want to account for agreement between major constituents in the sentence. A Swedish example is the agreement of predicate adjectives with the subject NP: Huset är rött 'the house (neuter) is red', Bilen är röd 'the car (utrum) is red', Bilarna är röda 'the cars (plural) are red'.

The discussion above leads up to the following suggestion: that noun phrases are marked for all relevant morphological dimensions,[3] such as Number, Gender etc. We shall assume that certain lexical categories (e.g. nouns) have such morphological dimensions specified in the lexicon. Then it can be said that noun phrases as a whole take their *morphological properties* (specific values for various morphological dimensions) from the component which has the relevant morphological dimension specified in the lexicon. This is done in accordance with a set of rules called *assignment conventions* given below as (AC 1)-(AC 5). We now have a way of deciding what morphological properties an NP has, and we can let words in an NP agree with that NP, or, as we shall see later, sometimes with part of that NP. The *spelling-out rules for NP*, (SP 1) - (SP 4) below, mark by means of a secondary *agreement-operation* parts of NP's as undergoing agreement with an NP. For the further spelling-out of agreement on a morphological level, it is also necessary to know in which dimensions a category or an operation agrees.

Let us now decide what morphological dimensions and properties must be considered in the treatment of Swedish noun phrases. In Section 1, I mentioned Number, Gender, and Definiteness, with the properties Singular, Plural; Utrum, Neuter; Indefinite and Definite. This is the traditional view based on the inflection of nouns. I would like to propose a third value for the dimension of Definiteness, namely Determinate,[4] which becomes useful when considering agreement in the NP as a whole. My reason for the introduction of this term is the somewhat complicated inflection of adjectives and nouns after determiners like denna, discussed on p.271. Other determiners with the same effect on the agreement of adjectives and nouns are genitive attributes and possessive pronouns.[5] Compare (11), (12), and (13) to (14), (15), and (16) below:

(11)	*denna gröna bil*	'this green car'
(12)	*Pelles gröna bil*	'Pete's green car'
(13)	*min gröna bil*	' my green car'
(14)	*den gröna bilen*	'the green car'
(15)	*den här gröna bilen*	'this green car'
(16)	*en grön bil*	'a green car'

In traditional grammar, (14) - (16) are considered the normal cases, since there the adjective and the noun have either (as in (14) and (15)) both definite form or (as in (16)) both indefinite form. In (11) - (13) the adjective has definite form and the noun indefinite form.

The solution proposed here thus involves the introduction of the morphological property Determinate. The members of the lexical category of Determiners (DET) have a value for Definiteness obligatorily associated with them. *Def* (the definite article), *Den här* and *Den där* are Definite, while *Denna* is Determinate (We are leaving genitival attributes and possessive pronouns out of consideration). The definite form of adjectives is triggered by Definite or Determinate, while the definite form of nouns is triggered by Definite and not Determinate. In this framework, (11)-(13) are Determinate NP's, while (14) and (15) are Definite and (16) is Indefinite. The difference in morphological properties explains the differences in inflection between (11)-(13), (14)-(15) and (16).

The dimensions and properties that I use here are the following (with the unmarked property for each dimension first):

Dimension	*Properties*
Number	Singular/Plural
Gender	Utrum/Neuter
Definiteness	Indefinite/Definite/Determinate

Diagram (10) below is a concise statement of
(a) the morphological dimensions which are specified in the lexicon for each category or operation,
(b) the dimensions in which each category or operation agrees.

Diagram 10

Category or operation	Specified for/as			Agrees in		
	Number	Gender	Definiteness	Number	Gender	Definiteness
Common noun		X		X		X
Adjective				X	X	X
Numerals[a]	X				X[b]	
Def, Den här			Definite	X	X	
Denna			Determinate	X	X	

a) Numerals are a subset of the operational category QUANT.
b) Only En agrees in gender.

Morphological properties are assigned to NP's by the following assignment conventions.

Assignment Conventions

(AC 1) An NP is Plural iff its highest QUANT is Plural.
(AC 2) An NP is Neuter iff its highest CN is Neuter.
(AC 3) An NP is Determinate iff its highest operation is Determinate.
(AC 4) An NP is Definite iff its highest operation is Definite.
(AC 5) If, after the application of (AC 1)-(AC 4), an NP is unspecified for some dimension(s), it gets the unmarked property for that (those) dimension(s).

(AC 1) - (AC 5) operate on the categorial structure. The formulation highest QUANT etc is intended to mean the highest instance of this category in the categorial structure of the NP in question. The notion 'highest' is, for practical purposes at least, quite straightforward. In order to show this, I will give some examples of categorial structures for NP's.

(17) den gröna bilen 'the green car'
DNP=DET0(CNP1)
DET0=Def
CNP1=ADJ0(CNP1)
ADJ10=Grön
CNP11=CN0
CN110=Bil

Let us now consider how morphological properties are assigned to (17). This DNP contains no instance of QUANT, so according to (AC 5), it is Singular. The highest CN is Bil, which is lexically specified as Utrum. The highest operation is Def. Def is lexically specified as Definite, so (AC 3) and (AC 4) tell us that this DNP is Definite.

(18) dessa två sköna kvinnor 'these two beautiful women'
DNP=DET0(QNP1)
DET0=Denna
QNP1=QUANT0(CNP1)
QUANT10=Två
CNP11=ADJ0(CNP1)
ADJ110=Skön
CNP111=CN0
CN1110= Kvinna

In (18), the highest QUANT, Två, is lexically specified as Plural, the higest CN, Kvinna, as Utrum, and the highest operation, Denna, as Determinate. Consequently, the assignment conventions tell us that this DNP is a Plural,Utral, and Determinate NP.

(19) en av tio filmstjärnor 'one of ten movie stars'

QNP=QUANT0(QNP1)
QUANT0= En
QNP1=QUANT0(CNP1)
QUANT10=Tio
CNP11=CN0
CN110=Filmstjärna

(19) is a rather interesting example, since it contains two instances of QUANT. It is a singular NP, morphologically and syntactically, so it must be the case that the highest QUANT in QNP, En, determines the Number of QNP. The highest QUANT in QNP1, Tio, is Plural, so QNP1 must be a Plural NP. Since filmstjärnor is Plural, it evidently agrees with QNP1 and not with QNP. In fact, prepositions (like, among other things, the genitive -s) generally seem to mark what could somewhat humorously be termed 'breach of agreement' within an NP: What comes before and what comes after the preposition behave like separate units with respect to agreement. As can be seen from (19), this last statement needs some qualification: En in fact agrees in Gender with Filmstjärna. Assignment conventions assign the properties Singular, Utrum and Indefinite to QNP, and Plural, Utrum and Indefinite to QNP1. The syntactic spelling-out rules for NP take care of the problems of 'breach of agreement' mentioned earlier. It is evident that we will need to know the morphological properties of both QNP and QNP1 in the spelling-out of (19).

(20) en av de tio filmstjärnorna 'one of the ten movie stars'

QNP=QUANT0(DNP1)
QUANT0=En
DNP1=DET0(QNP1)
DET10=Def
QNP11=QUANT0(CNP1)
QUANT110=Tio
CNP111=CN0
CN1110=Filmstjärna

(20) is included to show the merits of the formulation highest operation in (AC 3) and (AC 4). We do not want every NP that contains a DET to become Determinate or Definite. We only want DNP's to have these properties. DNP's are NP's that have a DET as their highest operation. In (20) we do not want QNP to be Definite, but we do want DNP1 to have this property.
(AC 3) and (AC 4) give exactly this result. Of course this is another example of 'breach of agreement', like (19). The properties assigned to the two NP's in (20) that are relevant for agreement are the following: To QNP: Singular, Utrum, Indefinite. To DNP1: Plural, Utrum, Definite.

Interpreting highest in the obvious way as 'uppermost in the categorial structure', we can use (AC 1) - (AC 5) to assign morphological properties to NP's with a fair amount of correctness.[6]

3 SPELLING-OUT RULES FOR NOUN PHRASES

The notation used in (SP 1) - (SP 4) below differs somewhat from that used in Dahl, Järborg & Källström 1974. Everything in the rules that is written with capitals is the name of a category, and everything written with an initial capital plus ordinary letters is the name of an operation or an argument. The notation CNPa etc. is used in the same way as CNP1 in Dahl, Järborg & Källström 1974, i.e. as meaning roughly 'some specific instance of category CNP etc.'.

The main innovation of (SP 1) - (SP 4) is the use of the immediately dominating category of what is spelled out, i.e. the use of what appears to the left of the equals signs in the categorial structures. This information is essential to spelling-out rules that involve agreement, since it is often necessary to refer to the NP as a whole (see rules (SP 2), (SP 3:i) and (SP 4)). The proper way of interpreting a rule of the form X=Y(Z)⇒W is 'If X has the analysis Y(Z), it is spelled out as W'.
Of course, I could have given this information in the traditional way, as a condition stated in words after the rule proper, but I think that my notation is more concise, simple and even elegant, since it makes further use of a notational device already present in the categorial structures.

Spelling-Out Rules for NP

(SP 1) CN

Categorially: CN → CNP

$CNPa=CNb(NPc^{x},NPd^{y},\ldots,NPX^{z}) \Rightarrow CNb^\frown\{K_{x}(NPc),K_{y}(NPd),\ldots,K_{z}(NPX)\}$

Examples: $CNPa=Fader(Kalle^{Till0}) \Rightarrow$ fader till Kalle 'father of Kalle'

(SP 2) ADJ

Categorially: CNP → CNP

$CNPa=ADJb(CNPc) \Rightarrow Agree_{CNPa}(ADJb)^\frown Agree_{CNPa}(CNPc)$

Examples: CNPa=Stor(Häst) ⇒ stor häst 'big horse'
CNPa=Stor(Hus) ⇒ stort hus 'big house'
CNPa=Stor(Röd(Boll))) ⇒ stor röd boll 'big red ball'
(through recursive application of the rule).

(SP 3) DET

Categorially: $\left\{\begin{matrix}CNP\\QNP\end{matrix}\right\} \rightarrow DNP$

(i) $DNPa=DETb(NPc) \Rightarrow Agree_{DNPa}(DETb)^\frown Agree_{DNPa}(NPc)$
where $NPc \in \left\{\begin{matrix}CNP\\QNP\end{matrix}\right\}$

(ii) $Agree_{DNPa}(Def) \Rightarrow \emptyset$ in context $\_\_{}^\frown Agree_{DNPa}(CNX)$

Examples: DNPa=Def(Häst) ⇒ hästen 'the horse'
DNPa=Def(Stor(Häst)) ⇒ den stora hästen 'the big horse'
DNPa=Denna(Häst) ⇒ denna häst 'this horse'
DNPa=Denna(Två(Häst)) ⇒ dessa två hästar'these two horses'
DNPa=Denhär (Häst) ⇒ den här hästen 'this horse'

(SP 4) QUANT

(i) Categorially: $\left\{\begin{matrix}DNP\\QNP\end{matrix}\right\} \rightarrow QNP$

$QNPa=QUANTb(NPc) \Rightarrow Agree_{QNPa}(QUANTb)^\frown Av(NPc)$

where $NPc=\left\{\begin{matrix}DETX(QUANTY(CNPZ))\\QUANTX(CNPY)\end{matrix}\right\}$

Examples: QNPa=Två(Def(Plur(Häst))) ⇒ två av hästarna
'two of the horses'
QNPa=En(Denna(Två(Häst))) ⇒ en av dessa två hästar
'one of these two horses'
QNPa=En(Tio(Hus)) ⇒ ett av tio hus 'one of ten houses'

(ii) Categorially: CNP → QNP
$\text{QNPa=QUANTb(CNPc)} \Rightarrow \text{Agree}_{\text{QNPa}}\text{(QUANTb)} \frown \text{Agree}_{\text{QNPa}}\text{(CNPc)}$

Examples: QNPa=En(Hus) ⇒ ett hus 'a house'
QNPa=Tre(Häst) ⇒ tre hästar 'three horses'

(iii) $\text{Agree}_{\text{QNPa}}\text{(Plur)} \Rightarrow \emptyset$

Example: QNPa=Plur(Häst) ⇒ hästar 'horses'

The rules I have proposed here are amended versions of the NP rules in Dahl, Järborg & Källström 1974, which did not interact very well in the generation of more complicated NP's. In particular, the rules in Dahl, Järborg & Källström 1974 could not cope with agreement in a satisfactory way. Furthermore, those rules introduced Plur only as a secondary operation performed in spelling out certain QUANT's. I have tried to extend and generalize the treatment of number here.

In many transformational treatments, the plural is introduced as a *feature* of the noun. There are three ways of introducing features in transformational grammar: Features can be
(a) inherent (lexically specified) or
(b) introduced by the base rules or
(c) transformationally derived.
(See Chomsky 1965,171 ff.)
The plural of nouns is introduced by the base rules, the argument for this being that the plural is necessary for the semantic interpretation. (See e.g. Chomsky 1965, 171 ff. and Kiefer 1970, 26). However, the plural of such things as adjectives would presumably be regarded as transformationally derived, since this is a pure agreement phenomenon and thus redundant and without consequences for the semantic interpretation.

The way I have treated the plural here, it is introduced as (a) a lexical property of QUANT[7] (notably Numerals and Plur), and as (b) the result of agreement operations. Thus, wherever we have the plural in an NP, it is present in the categorial structure (which is the structure relevant for semantic interpretation) in the form of an inherent property of an operation. The plural of nouns only arises as the result of agreement with a QUANT. This is a perfectly natural solution for cases like the following: en häst 'one horse', två hästar 'two horses', alla hästar 'all horses', varje häst 'every horse'. Somewhat less natural is the QUANT Plur, which is lexically specified as Plural, causes plural form of the noun but is never realized as such on the surface. Letting Plur belong to QUANT has at least two advantages: All plural NP's belong to the same category QNP, and the formulation of (AC 1) can be kept as simple as it is. It should be kept in mind however that Plur is a somewhat deviant QUANT. It is never realized on the surface, and it is only an operation from CNP to QNP, while nearly all the other QUANT's are also operations from QNP or DNP. Plur can in other words only be spelled out according to (SP 4: ii), never according to (SP 4:i). Whether we call Plur a QUANT or let it be an operation of its own category, it amounts to the same thing: we want to have a primary (and thus meaning-bearing) operation to use in cases where there is no (overt) QUANT to agree with and the choice of number thus seems entirely free.

The number of QUANT is always lexically specified and thus corresponds to inherent features in transformational theory. The plural of other categories arises through agreement operations, which correspond to the introduction of features by transformation. The Plur-operation could be regarded as the marking of categorial structures as plural, and seems equivalent to the use of base-introduced features in transformational grammar. The proposal outlined here is perhaps somewhat more attractive than the transformational treatment sketched in Chomsky 1965, in particular since the categorial structure of every plural NP need not be marked as being plural. When the plural of an NP is the automatic consequence of the presence of an (overt) QUANT, nothing need be said in the categorial structure about the plurality of that NP.

The Spelling-out Rules for NP are intended to take us to a level where all the constituents are concatenated and some of them are marked as undergoing agreement with some NP. In other words, they are in principle symbols of the form $\mathrm{Agree}_{NPX}(Y)$. However, (SP 1) - (SP 4) alone cannot always take us all the way to this level. We need the help of some supplementary convention to take care of the hierarchy of agreement that often results from the application of (SP 1) - (SP 4). In order to clarify this point and to demonstrate the function of (SP 1) - (SP 4), I will make a detailed derivation of an NP.

(21) en av de två bruna hästarna 'one of the two brown horses'

Categorial structure:

QNP=QUANT0(DNP1) (1)
QUANT0=En (2)
DNP1=DET0(QNP1) (3)
DET10=Def (4)
QNP11=QUANT0(CNP1) (5)
QUANT110=Två (6)
CNP111=ADJ0(CNP1) (7)
ADJ1110=Brun (8)
CNP1111=CN0 (9)
CN11110=Häst (10)

Now let us trace the derivation of (21) from its categorial structure.

Step 1: Look at line (1) of the categorial structure. (SP 4:i) could be applicable, but since it contains conditions on the internal structure of NPc in the rule (=DNP1 in the categorial structure), we have to check that DNP1 meets these conditions. This is done by tracing DNP1 downward in the categorial structure. The relevant lines to consult are (3) and (5). After having done this, we see that DNP1 has the internal structure DET10(QUANT110(CNP111)) and thus meets the output condition for (SP 4:i). Application of this rules gives the following result:

$$\underline{\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\mathrm{Av}\,(\mathrm{DNP1})}$$

Step 2: Av(DNP1) is spelled out in accordance with the metarule Functors-to-the-Left (Dahl, Järborg & Källström 1974, 3). After applying that, we have:

$$\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\underline{\mathrm{Av}^\frown\mathrm{DNP1}}$$

Step 3: Look at line (3) in the categorial structure. DNP1 has the structure DET10(QNP11), so (SP 3:i) is applicable. Result:

$$\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\mathrm{Av}^\frown\underline{\mathrm{Agree}_{DNP1}(\mathrm{DET10})^\frown\mathrm{Agree}_{DNP1}(\mathrm{QNP11})}$$

Step 4: Spelling-out rules apply in a top-down fashion (Dahl, Järborg & Källström 1974, 2). This means that the outermost operation is carried out before any operations in the argument of this operation may be carried out. This principle can be overruled by another principle to the effect that primary operations are carried out before any lower-level operations. (See Dahl,'Operational Grammars', for those different types of operations). Since Agree is a lower-level operation, we can now go on to spell out QNP11, which has the internal structure QUANT110(CNP111) (line 5)). We apply (SP 4:ii) and get the following result:

$$\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\mathrm{Av}^\frown\mathrm{Agree}_{DNP1}(\mathrm{DET10})^\frown\mathrm{Agree}_{DNP1}\,(\underline{\mathrm{Agree}_{QNP11}(\mathrm{QUANT110})^\frown\mathrm{Agree}_{QNP11}(\mathrm{CNP111})})$$

Step 5: Look at line (7) in the categorial structure. CNP111 has the internal structure ADJ1110(CNP1111). (SP 2) applies:

$$\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\mathrm{Av}^\frown\mathrm{Agree}_{DNP1}(\mathrm{DET10})^\frown\mathrm{Agree}_{DNP1}\,(\mathrm{Agree}_{QNP11}(\mathrm{QUANT110})^\frown\mathrm{Agree}_{QNP11}(\underline{\mathrm{Agree}_{CNP111}(\mathrm{ADJ1110})^\frown\mathrm{Agree}_{CNP111}(\mathrm{CNP1111})}))$$

Step 6: Look at line (9) in the categorial structure. CNP1111 has the structure CN11110. (SP 1) applies:

$$\mathrm{Agree}_{QNP}(\mathrm{QUANT0})^\frown\mathrm{Av}^\frown\mathrm{Agree}_{DNP1}(\mathrm{DET10})^\frown\mathrm{Agree}_{DNP1}\,(\mathrm{Agree}_{QNP11}(\mathrm{QUANT110})^\frown\mathrm{Agree}_{QNP11}(\mathrm{Agree}_{CNP111}(\mathrm{ADJ1110})^\frown\mathrm{Agree}_{CNP111}\underline{(\mathrm{CN11110})}))$$

Step 7: Let us now insert the lexemes specified on lines (2), (4), (6), (8) and (10) in the categorial structure. Nothing requires us to do that at any special point in the derivation. I have chosen to insert the lexemes now for the sake of clarity of exposition.

$$\text{Agree}_{QNP}(\text{En})\frown\text{Av}\frown\text{Agree}_{DNP1}(\text{Def})\frown\underline{\text{Agree}_{DNP1}(\text{Agree}_{QNP11}(\text{Två})}\frown$$

$$\frown\underline{\text{Agree}_{QNP11}(\text{Agree}_{CNP111}(\text{Brun})\frown\text{Agree}_{CNP111}(\text{Häst})))}$$

It is obvious that the constituents are not concatenated with each other the way we want them to be. The reason is also obvious: agreeing structures sometimes involve agreement operations themselves, so we get a hierarchy of agreement operations to perform on the same lexeme. Whenever this happens, it seems to be the highest Agree-operation that takes precedence over the lower ones. It is noteworthy in this connection that it is always the 'unmarked' rules (SP 2), (SP 3:i) and (SP 4:ii) that contribute to this complication. These rules just add another preposed modifier to the NP without complicating the structure of the NP very much. They never introduce such things as 'breach of agreement'. Successive application of these rules (and/or recursive application of (SP 2)) never introduce a new head noun. So what we want is a convention to the effect that whenever we have an expression like the one underlined above in Step 7, we can simplify it by letting the highest Agree-operation replace all the lower ones within its scope.
The agreement incorporation convention (AIC) below is intended to have this effect.

The Agreement Incorporation Convention

(AIC) $\text{Agree}_{NPX}(\text{Agree}_{NPY}(\alpha)\frown\ldots\frown\text{Agree}_{NPY}(\beta))$ can be simplified to

$\text{Agree}_{NPX}(\alpha)\frown\ldots\frown\text{Agree}_{NPX}(\beta)$ iff in the categorial structure NPY appears to the right of the equals sign where NPX appears to the left.

The notion 'appear to the right of the equals sign where something else appears to the left' corresponds in linguistic terms to immediate domination. It seems that (AIC) has to apply either in a top-down or a bottom-up fashion, but not in a random manner, if it is to give the desired result. Let us now apply (AIC) to the result of Step 7 and see what we get.

Step 8: (AIC) can apply twice to the underlined part of what we have in Step 7. I will show this in two steps, applying (AIC) in a top-down manner.

$$\text{Agree}_{\text{DNPl}}(\text{Agree}_{\text{QNPll}}(\text{Två})\frown\text{Agree}_{\text{QNPll}}(\text{Agree}_{\text{CNPlll}}(\text{Brun})\frown\text{Agree}_{\text{CNPlll}}(\text{Häst})))$$

(AIC)

$$\Downarrow$$

$$\text{Agree}_{\text{DNPl}}(\text{Två})\frown\text{Agree}_{\text{DNPl}}(\text{Agree}_{\text{CNPlll}}(\text{Brun})\frown\text{Agree}_{\text{CNPlll}}(\text{Häst}))$$

(AIC)

$$\Downarrow$$

$$\text{Agree}_{\text{DNPl}}(\text{Två})\frown\text{Agree}_{\text{DNPl}}(\text{Brun})\frown\text{Agree}_{\text{DNPl}}(\text{Häst})$$

So the final result of the rules proposed so far applied to the categorial structure of (21) is the following:

$$\text{Agree}_{\text{QNP}}(\text{En})\frown\text{Av}\frown\text{Agree}_{\text{DNPl}}(\text{Def})\frown\text{Agree}_{\text{DNPl}}(\text{Två})\frown\text{Agree}_{\text{DNPl}}(\text{Brun})\frown\text{Agree}_{\text{DNPl}}(\text{Häst})$$

We now have all the constituent words of the NP concatenated in their correct order. All the words have the same form: a functor-forming operation to be performed on a lexeme. The syntactic part of the derivation of NP's is finished when we have reached this level. The rest of the derivation concerns words, not phrases or sentences, and is morphological (and, on a still lower level, phonological) in character. The first step in the morphological derivation must be to find the morphological properties of the NP's involved in agreement (i.e. the indices of the Agree-operation). Of course, this can be done by means of the assignment conventions, in the manner illustrated on pp. 277-9. Applied to our example, the lexemes get the following morphological properties:

En : Singular, Utrum, Indefinite (⇒ *en*)
Av : Ø (⇒ *av*)
Def : Plural, Utrum, Definite (⇒ *de*)
Två : Plural, Utrum, Definite (⇒ *två*)
Brun: Plural, Utrum, Definite (⇒ *bruna*)
Häst: Plural, Utrum, Definite (⇒ *hästarna*)

More will be said about morphology in section 5.

4 ALTERNATIVE APPROACHES TO AGREEMENT

The description of agreement that has been outlined in the preceding sections was conceived within the framework of 'early' operational grammar. More examples of this early grammar can be found in Dahl, Järborg & Källström 1974 and the first part of Dahl&Järborg 1975. Dahl's 'Swedish Operational Grammar' (this volume), however, represents a later version of operational grammar, where the use of general metarules has been extended considerably as compared to early versions. The later version includes, among other things, two notions that are directly relevant for agreement rules: these are the 'control rule' and the 'spelling-out index'.

One of the functions of the control rules is to find the expressions that control agreement between main constituents in a sentence. For Swedish, we must find the NP that controls the agreement of the predicative.

A spelling-out index can be either syntactic or morphological. A syntactic index specifies which particle to select as the marker of a syntactic function. For example, a syntactic index governs the insertion of *by* to mark the agent in passive sentences. Morphological indices select different forms of a lexeme in different syntactic environments. For example, in Swedish, a morphological index selects the passive form of the verb in passive sentences. The morphological index, enlarged with inherent morphological properties if any, determines the morphological form of the lexeme.

Within a 'late' theory, we can think of the grammatical word[9] as a lexeme with a morphological index. If we decide that all the (inflectable) lexemes must have a morphological index, we can take care of agreement without having to use the Agree-operation, provided that we make certain that agreeing lexemes receive compatible morphological indices. This can be done in either of two ways (cf. 'Swedish Operational Syntax', §15). The first way is parallel to the one sketched in the preceding sections of this paper and in the main body of Dahl's paper: lexemes are assigned morphological properties according to their syntactic position. Dahl discusses the second way briefly towards the end of his paper. Instead of being assigned to lexemes in the course of the derivation of a sentence, morphological indices are present in the categorial structures, while co-occurrence restrictions filter out non-permissible combinations of grammatical words.[8] Dahl advocates the second line of thinking. Whichever of the two alternatives we choose, however, the 'late' theory seems better able to cope with agreement than the 'early' one, simply because it makes the rather ad-hoc step involving the Agree-operation unnecessary.

5 SOME REMARKS ABOUT INFLECTIONAL MORPHOLOGY

In this section, I will give some hints about how the morphological part of an operational grammar is constructed.

General properties of an operational morphology

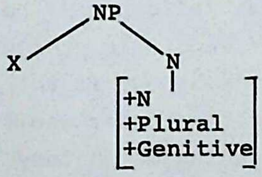
A lexeme[9] with a morphological index (a bundle of morphological properties) is a grammatical word[9] in the sense of Lyons 1968. The task of the rules of inflectional morphology is to turn a grammatical word into a phonological word[9] which is the realization of this particular grammatical word.

The representation of the word in the form of a lexeme with morphological properties is typical of the Word-and-Paradigm approach (see e.g. Matthews 1972). This is in itself nothing new in different kinds of generative grammar. In transformational grammar, for example, this view of morphological structure was defended in Chomsky 1965.

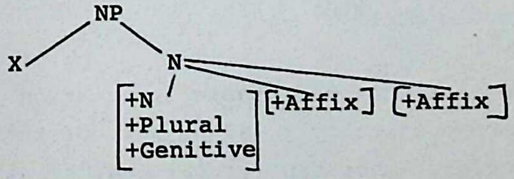
Within the theory of operational grammar, it seems perfectly natural that morphological rules that spell out phonological words should be process rather than arrangement. Morphological processes can be of several different kinds. In Swedish, we have affixation, internal change, and suppletion. Another type is reduplication. These processes involve the addition, change, substitution, and copying of phonological material. Deletion of phonological material cannot be excluded as a morphological process either, on *a priori* grounds. Various prosodic changes can also be used systematically in morphology (such as change of tone, lengthening, shortening, stress shifts, etc.). The limiting case of a morphological operation is the identity operation, where nothing is changed.

A process theory where suffixation and internal change are treated as different but equal processes is to my mind more satisfactory than an arrangement theory where internal change is treated as a special type of suffixation. Nevertheless, although some transformational grammarians favour Word-and-Paradigm representations, most still tend to use an arrangement rather than a process type of morphology. In Kiefer 1970, syntactic transformations called 'affixation rules' give an 'arranged' structure to the grammatical words. Thus (22) is turned into (23):

(22)



(23)



This amounts to saying that a word form like mäns 'men's' 'on a deeper level' contains two suffixes. The reason for this analysis is of course that in most cases, Plural and Genitive in nouns are realized as separate suffixes. Leaving aside the issues involved when syntactic rules are used to spell out word-internal structure, it is doubtful whether this way of reducing surface variation to underlying regularity is necessary and justified. The only regularity 'on a deeper level' there is to account for, is the one already contained in (22): the word has the morphological properties Plural and Genitive. So, in operational grammar, a representation equivalent to (22) is the input to the morphological rules, which then derive a form like mäns directly without the unnecessary step via a representation like (23).

Given a lexeme, a set of morphological properties, and lexical information about the lexeme, the morphological component of an operational grammar should specify an ordered set of operations to be performed on the phonological representation of the lexeme, and then through the ordered application of these operations derive the correct phonological word.

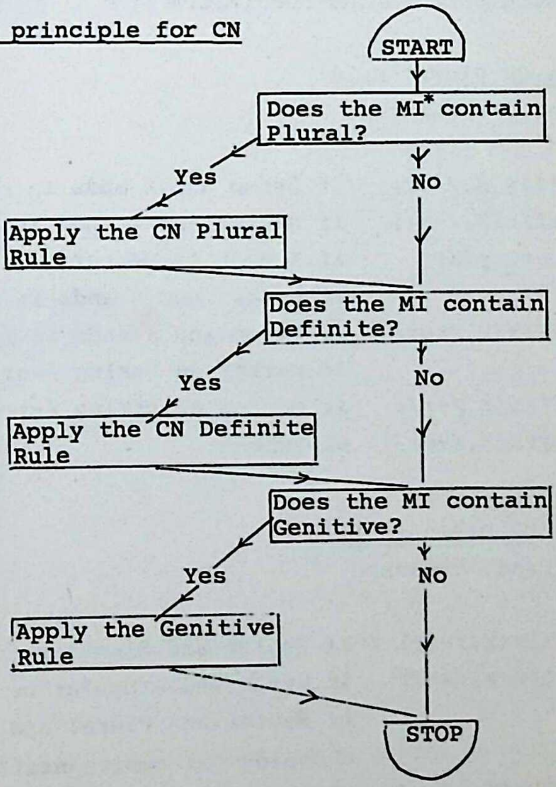
A preliminary outline of the morphological component

Illustrations in the outline that follows will be taken from the morphology of CN. The reader who is interested in the details of a Word-and-Paradigm morphology is referred to Matthews 1972 (esp.Part III) and the reader who is interested in a more detailed account of Swedish morphology from a generative point of view is referred to Kiefer 1970, Linell 1972 and references there.

The *lexicon* contains non-predictable information about the lexemes. The morphologically relevant part of that information includes categorial membership (Plural and Definite work differently with respect to Swedish CN and ADJ), phonological representation (here we choose the unmarked form of the lexeme, for CN the nominative singular indefinite form), inherent morphological properties (for CN gender), inflectional class membership (which must be indicated for some Swedish CN: cf. gäst 'guest'- gäster (plur.) but häst 'horse'- hästar (plur.)) morphophonological behavior (cf. Swedish CN: bok 'book'- böcker (plur.) but tok 'fool'- tokar (plur.)), suppletive forms, missing forms, and, sometimes, semantic representation (cf. e.g. the dialects of Swedish which use the /-e/ instead of /-a/ in words that are semantically masculine).

The *morphological spelling-out principles* can be represented as a flow chart (cf. Matthews 1972, 178 and 195 and Dahl 'Swedish Operational Syntax', 126f). One general chart should be enough to take care of the whole of Swedish morphology. This chart then should tell us, given a lexeme and its morphological index, exactly what rules to apply, and in what order to apply them. (24) is an illustration, which is valid for CN only and thus only a part of a comprehensive treatment of Swedish morphology.

(24) Spelling-out principle for CN


START
Does the MI* contain Plural?
Yes
No
Apply the CN Plural Rule
Does the MI contain Definite?
Yes
No
Apply the CN Definite Rule
Does the MI contain Genitive?
Yes
No
Apply the Genitive Rule
STOP

*MI = morphological index.

Morphological rules, finally, tell us which process (or processes) to apply. They can be thought of as blocks containing several subcases, out of which one should fit each grammatical word that has been 'sent' to the rule by the spelling-out principles. In the simplest case, of course, the block contains only one sub-case. Each block derives a possible form (or at least part of a possible form) of a lexeme. The operand of the rules can in principle be the phonological representation of the lexeme, some stem, or a possible form (or part thereof) of a lexeme. Here we assume that the unmarked operand is the phonological representation (i.e. the unmarked form) or, if earlier rules have applied, the phonological result of the application of these rules. If no rule applies, the unmarked form is derived. Three rule blocks for CN are given below: the CN Plural the CN Definite Rule (26), and the Genitive Rule (27). The Genitive Rule is simple[10] and covers all cases. The other two cover most Swedish CN's but exclude some. They both presuppose an analysis where an epenthetic /e/ is sometimes inserted before single consonant suffixes.

(25) The CN Plural Rule

Operand: Unmarked

Suffix(X,/-or/)	if Utrum and X ends in /-a/.
Suffix(X,/-n/)	if Neuter and X ends in a vowel.
Identity(X)	if X ends in /-are/ or if Neuter and X ends in a consonant.
Suffix(X,/-ar/)	if Utrum and X ends in /-e/ or if marked as taking /-ar/-plural.
Suffix(X,/-r/)	if marked as taking /-r/-plural.
Suffix(X,/-er/)	elsewhere.

(26) The CN Definite Rule

Operand: Unmarked

Suffix(X,/-t/)	if Neuter and Singular.
Suffix(X,/-n/)	if Utrum and Singular or if Neuter and Plural and X is the phonological representation of the lexeme.
Suffix(X,/-na/)	elsewhere.

(27) The Genitive Rule

Operand: Unmarked.

`Suffix(X,/-s/)`

The subcases of the morphological rules are disjunctively ordered: You start from the top and work your way down until you find the first rule that fits. Notice that the formulation of the rules can be kept rather simple at least as compared to the morphological rules of many transformational grammarians. The unreadability of morphological rules is one of the unfortunate consequences that stem from the fact that the format of generative phonological rules has been used for the formulation of morphological rules. Another such consequence is the practice of copying the syntactic, morphological and (presumably) also the semantic features of a word onto each phonological segment of it. Clearly, the semantic, syntactic, and morphological properties of a word are not properties of its component phonemes, but belong to a higher level of abstraction.

FOOTNOTES

1. *Utrum* is used e.g. by Beckman 1964 and Kiefer 1970. A possible English term is *common*, since utrum covers reale, masculine and feminine gender. In many Swedish dialects, a distinction within utrum between masculine on the one side, and reale and feminine on the other, shows up in the inflection of such things as adjectives. This problem is not considered here.

2. There are several dialectal differences. What is said here is true for what most people would accept as Standard Swedish.

3. I use *dimension*, since *category* in operational grammar refers to categories of expressions.

4. I owe this proposal to Östen Dahl.

5. This inflection appears, strangely enough, in vocative phrases like lilla vän 'little friend', du falska kvinna 'you deceitful woman'.

6. (AC 1) - (AC 5) say nothing of the morphological properties of conjoined NP's. This can be defended on the grounds that Swedes are often at a loss as to what gender or number to give to conjoined NP's where the conjuncts have different gender or number. Witness (1) - (2):

   (1) Äpplet eller bananen är gul/gult/gula

   'The apple (Neuter) or the banana (Utrum) is yellow (Neuter/Utrum/Plural)'

   (2) Flickan eller pojkarna är kommunist/kommunister

   'The girl or the boys is (are?) Communist/Communists'

7. That the number of numerals is a morphological property separated from the semantic number is shown by languages that always use the singular after numerals. Finnish and Hungarian are such languages.

8. I do not think, though, that the restrictions are quite as simple as Dahl puts them.

9. See Lyons 1968, 196-7, for a definition of these terms. Matthews 1972 and 1974 makes the same distinctions but uses different terminology.

10. The genitive is simple on the morphological level, but not on the syntactic. Since genitive is an NP rather than a word property, there is a tendency to mark the last word of an NP with the /-s/-suffix. In case that word is not the main word of the NP, the acceptability of the NP may decrease according to more or less subtle rules.

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